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EXAMINING GENDER DIFFERENCES IN BASIC AND CRITICAL ONLINE READING SKILLS

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ABSTRACT

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Previous studies suggest that girls and boys may differ in reading achievement in offline and online reading. However, there are a limited number of studies that have investigated whether gender is associated with students' performance on basic reading skills and component skills of credibility evaluation for online texts. Consequently, the aim of this study was to investigate gender differences in basic reading skills (i.e. reading fluency and reading comprehension) and online information evaluation skills.

Two hundred and seventy-four 6th-grade students (145 girls,122 boys) participated by completing a reading fluency test, comprehension test and critical online reading task. Overall, girls had better performance in reading fluency, and no gender differences were found in reading comprehension. For the credibility evaluation task, the result didn't show a statistically significant difference between girls and boys, indicating they might have similar results, and both suffer from a lack of proficiency in questioning the credibility and justifying the credibility.

Additionally, associations between students' basic reading skills and credibility evaluation skills were explored to determine whether the association varied by the student's gender. It was found that both basic reading skills were positively associated with students' credibility evaluation behaviour and the association between reading comprehension and the ability to justify the credibility was relatively strong. However, there's no gender difference in all the associations. This study's findings suggest that students need more instruction on credibility evaluation, and there remains a need in support of boys' basic reading skills.

Keywords: adolescents, credibility evaluation, online reading, information literacy

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1 INTRODUCTION

In our modern digital and information-rich environment, digital literacy and online reasoning take on added importance. The Internet has given people more freedom to publish information, which makes online information questionable in quality, especially those published in unreliable media channels or under commercial intent (Britt & Gabrys, 2001; Pérez et al., 2018). Therefore, information evaluation is an essential component (Bråten et al., 2009) in online research and comprehension practices (Kiili et al., 2021).

Adolescent students would be vulnerable to misinformation if they don't develop the skills necessary to critically evaluate reliability of information. Nevertheless, evaluating the information on the internet has been recognized as a weakness among students (Bråten et al., 2018; Coiro et al., 2015; Goldman et al., 2012) as well as the most demanding task for online information comprehension (Leu, et al., 2015).

In addition, students need more direct instruction on how to learn from the internet, and there remains a need for effective pedagogy in support. Previous research has revealed that there are significant inter-individual differences among students, and it is important to consider individual factors when providing instructional guidance on critical reading skills. As one of the widely discussed factors, gender differences in reading have been observed in a number of studies as an exception of gender similarities hypothesis (GSH), which suggests that men and women are more similar than they are different in terms of their psychological traits, abilities, and behaviors (Hyde, 2005). These studies noted that girls tend to have better reading skills than boys and provided a growing body of evidence that they also differ in digital reading ability (Fraillon et al. 2020).

Investigating gender differences in print and online reading contexts can help build a deep understanding of how students learn and create instructional practices to support successful reading comprehension. However, there are a

limited number of studies that have investigated the gender differences ´in both basic reading skills and critical online reading skills. Therefore, this study will focus on gender differences in reading fluency, reading comprehension and critical online reading skills to understand students' reading abilities. As for critical online reading skills, in this study, it refers to the critical evaluation of online texts. As such, this study aimed to investigate the online information evaluation skills of girls and boys in online reading comprehension tests and, further, explore how gender is associated with different parts of basic and critical online reading skills. In addition, this study aimed to explore the association between basic reading skills and critical online reading skills and whether there’s a gender difference in the association between basic reading skills and critical online reading skills.

2 THEORETICAL BACKGROUND

2.1 Reading fluency

Reading fluency is considered to be an indicator of overall reading competence and a critical factor in reading development (Chall, 1983; Fuchs et al., 2001; NICHD, 2000). Reading fluency consists of three elements: (1) accuracy in word decoding, (2) automaticity in recognizing words, and (3) appropriate use of meaningful oral expression (Hudson, Lane, &Pullen, 2005). Reading accuracy reflects the capacity to decode words correctly (La Berge & Samuels, 1974). Good readers are proficient in using basic decoding skills to interpret the information in the texts and generalize the author's intentions incidentally (Fuchs et al., 2001).

The second element, automatic information processing from words is an important component of reading skills (Murray, 2016). It can be used to recognize the combination of letters and translate them into lexical representations in an effortless manner. Incorrect recognition of words can result in labored access to textual meaning and contextual analysis. The third element, the use of meaningful oral expression relates to the ability to utilize sound representations to translate written words into spoken language. Understanding sound-letter correspondence enables readers to perceive and decode words accurately (Murray, 2016).

Skillful reading requires complicated and concurrent coordination to achieve effortless and automagical execution within a short time (Logan, 1997), which ensures the ability to process the text rapidly. According to Logan (1997), skilful reading requires complicated and concurrent coordination to achieve effortless and automagical execution within a short time. He emphasizes that this ensures the ability to process the text rapidly, which means that the process of word decoding and recognition should be executed automatically with limited attentional resources to save more capacity of working memory for deep understanding of the structured texts. Importantly, dysfluent reading can lead to

difficulties in reading comprehension because the focus on words takes up too much cognitive resources which should be extensively used in high level thinking for comprehension process (LaBerge and Samuels, 1974).

Translating word recognition results into sound representations automatically is an obvious predictor of reading expertise and has been proved to be critically associated with reading comprehension. As the automaticity allows more attentional recourses allocated to comprehension functions (LaBerge & Samuels, 1974), the achievement of quick translation between written texts and its oral articulation may help construct meaning within and through sentences. In addition, according to LaBerge and Samuels (1974), a good understanding of text can be reflected by prosodic reading which is defined as various expression, inflection and rhythm in oral reading. Consequently, assessing oral reading fluency in a contextual setting is more meaningful to provide instruction for reading proficiency. Timed reading can be used when a test is administered to measure the number of words correctly read in a passage and the ability to retell the content after reading. And to measure the prosodic quality, the evaluator should have the scale or checklist to conduct the observation of students' reading performance.

Reading fluency can be accessed via silent and oral reading in varied forms (Kim et al., 2011). Basically, counting the number of words read incorrectly within a minute or 100 words of oral reading can help detect the potential deficiency in reading accuracy. To examine the development in word recognition, test of silent word reading fluency (TOSWRF) is used by assessing the number of printed words identified accurately and efficiently (Mather et al., 2004). The test provides a reliable and valid measure of students' ability to recognize words in a limited time without mistakes. During the test, students need to separate words written in an unrelated pattern without spaces and punctuations by drawing lines. This measurement of decoding words in nonword reading can provide information about reading automaticity as well because reading in an effortless manner entails the lexical knowledge which ensures rapid and sequential identification of letter combinations and phonemes in words.

2.2 Reading comprehension

Reading comprehension is seen as a process of constructing a mental representation in which the information from the text and the reader's knowledge base are combined spontaneously (Van Dijk & Kintsch, 1983). This cognitive process happens at different levels. At the first surface level of linguistic input, word identification and parsing the role of words in sentences support the understanding of the text itself (Kintsch & Rawson, 2008). This is achieved by accepting the proper meaning of an uncertain word or phrase and yielding the improper one (Kintsch, 1988). In addition to acquiring this language comprehension, the reader needs to move further to understand the information hierarchically presented in the text (Kintsch, 1998).

At the second level of forming a text base, several steps are involved in view of the construction-integration model (Kintsch, 1998). First, the text's ideas, concepts, and arguments are interpreted through sentence recognition and analysis, which requires the ability to parse the syntactic and semantic relations created in the text. Propositions are built in this step based on the output of parsing. Secondly, the information stored in the reader's long-term memory continuously keeps connected with the information clarified by the text during text processing. The reader retrieves prior knowledge relevant to the propositions which are derived from textual input and integrates the background knowledge with the propositions. This means that the reader encodes the text information and extracts meanings of the text together with a corresponding knowledge set. Within this integration phase, the propositions are elaborated by activating the parts of the knowledge base which are most likely to affect the meaning-making practice (Kintsch, 1998). And the microstructure is built by possessing the propositions and analyzing the complex interrelations of the propositions (Kintsch & Rawson, 2008). However, these propositions are just conceived as potential inferences obtained randomly without intelligence and guidance. Additional propositions are needed in the third step to create two crucial inferences that are necessary for coherent comprehension - bridging inferences and macropropositions (Kintsch, 1998). Bridging inferences functions with incoherence in the microstructure. Macropropositions, on the other hand, are used to build the high-order macrostructure following the macrorules of deriving

the global meaning of the text (Van Dijk & Kintsch, 1983). Importantly, macropropositions are also interlinked in the same way that propositions are (Kintsch, 1998). In the final step, specific provisions arrive at the text base consisting of microstructure and macrostructure. Strength values are assigned to the interconnection envisioned in previous steps. Thus, an associative network of text base is constructed and therefore can be described as a connectivity framework (Kintsch, 1998).

At the third level, successful comprehension of texts is achieved by constructing a deep-level, coherent situation model after amalgamating the text-based information and inferences. In this process, a fusion takes place between a text and the general knowledge and personal experience in the situation model where the comprehension arises from. Imagery and emotions are also involved in this level (Kintsch & Rawson, 2008).

While reading fluency is important for basic literacy skills, reading comprehension requires more advanced skills and strategies to fully understand and interpret the meaning of a text. However, accurate and fluent reading can predict expertise in reading comprehension. Studies on the association between reading comprehension and fluency (Artelt et al., 2001; Cutting & Scarborough, 2006; Rasinski et al., 2005) have shown that the effect of reading fluency on reading comprehension does not cease to exist although it seems to diminish at a later stage. Fluent reading depends on speed and accuracy in decoding words and word recognition. In order to develop the text base, readers must make use of their linguistic abilities which can be crucial instructions to the construction of situation models (Kintsch, 1992). That is, readers with limited vocabulary and word-reading skills may fail to elaborate on the main ideas of the text and integrate those ideas into a coherent representation. Additionally, the automaticity required by reading fluency largely frees up attentional resources that can be applied to higher-level thinking activities (Fuchs et al., 2001), such as understanding the connections between sentences and the meaning of text. If readers lack the literacy skills to identify words rapidly, they might have comprehension issues when reading and learning from the text (Perfetti & Stafura, 2014).

2.3 Credibility evaluation in online reading

Reading to learn from online information is 'a self-directed process of constructing text and knowledge when seeking answers to questions on the Internet' (Killi et al., 2018). Online reading emerges in a variety of settings that go beyond the mere act of reading (Alvermann, 2002; Drew, 2012), and therefore online comprehension requires a more complex process of thinking than offline reading. When people are searching for answers to certain questions in an online environment, five processing practices of online research and comprehension occur: (1) reading to identify important questions, (2) reading to locate information, (3) reading to evaluate information critically, (4) reading to synthesize information, and (5) reading and writing to communicate information (Leu et al., 2013). To successfully learn from online information, all the aforementioned skills are needed. In the present study, my focus will be restricted to the evaluation of online information, and in particular, evaluation of credibility of multiple online texts, that is the core of the critical online reading skill.

When determining if the information is credible, readers should evaluate different facets of information including content, source and context as it was described in CORE model (critical online resource evaluation) (Forzani et al., 2022). When readers evaluate content, they should not only pay attention to the relevance and quantity but also judge if other content-based features such as ideas, claims and arguments are reliable by assessing the evidence, reasoning and explanations (Forzani, 2020), and whether authors support their perspectives effectively (Brigandt, 2016; Bromme et al., 2015). In some cases, a process called as corroboration occurs when readers assess content by contrasting new information with both their past knowledge and information from other texts (Shanahan, Shanahan, & Misischia, 2011).

In the practice of evaluating the source credibility, effective readers pay attention to at least two aspects: expertise and trustworthiness (Flanagin & Metzger, 2008). They judge the expertise of the creator of the content (Bromme et al., 2015; Goldman et al., 2012) by using sourcing strategies helpful in ascertaining the author's educational background, competence, experience, credentials, and affiliation. As source authority is not always equal to source accuracy (Sinatra & Lombardi, 2020) and it's risky to trust an author with

insufficient professional knowledge (Afflerbach et al., 2013), readers should also judge whether the author's field of expertise corresponds to the topic described in the text (Killi et at., 2022). Another source feature to note is the author's purpose. Readers can value the credibility of the text by interpreting the authorial intention. If an author has a clear bias, he or she may be more likely to present information in a way that supports his or her purpose rather than presenting a balanced and objective account. On the other hand, benevolence which refers to good intentions or wills toward public or societal benefits is considered to be one of the bases for credibility evaluation (Hendriks et al., 2015). Additionally, an author's intention may not always be transparent or easily discernible from the text, readers, therefore, need to search for indicators of the author's integrity which entail his or her respect for professional norms and to make inference about the author's benevolence by determining whether their purpose is to be of benefit on the broader community (Hendriks et al., 2015).

When readers evaluate context, which refers to the temporal, social, and political setting of text (Forzani et al., 2022), they are assessing the overall trustworthiness of the situation in which the content is presented (Rieh, 2002) by using different document features, or textual clues, to make inferences about the setting. Ault et al. (2017) note that while online contexts provide extensive contextual information, it is not always sufficient for evaluating the overall credibility of the text by relying on one certain factor. To effectively evaluate the content, readers need to look beyond the single contextual information and delve deeper into the multiple factors, such as the genre and publication date of the text, and the endorsement.

One important contextual feature that have an impact on readers' credibility evaluation of online texts is genre (Killi et al., 2023). Readers can distinguish between different genres through specific formats and writing styles. However, the online environment makes the application of this knowledge difficult. This is because, internet sometimes blurred the boundaries of genres (Flanagin & Metzger, 2008), making identification of genres challenging (Leeder, 2016). Nevertheless, readers can distinguish between different genres, such as forums, blogs and encyclopedic entries based on the structure and feature of online texts, forms and conventions of expression. Previous study suggests that readers' preconceived opinions or experiences of genres might be a consideration when

judging the trustworthiness of online texts in different genres (Flanagin & Metzger, 2007).

When examining the factor structure of online reading, Kiili et al. (2018b) suggested that information evaluation may require two latent skills: confirming and questioning the credibility of online information. The factor structure was further examined by Kiili et al. (2023). In their study, students need to finish an article ranking task, and they were required to assess the author's expertise, benevolence and the quality of the evidence of four online texts beforehand. The online texts represented different genres, including a popular science article, a newspaper article, personal blog text and commercial text. The quality of the four texts also differed in three criteria: the expertise of the author, the benevolence of the author and the quality of evidence provided. The results replicated the earlier finding that credibility evaluation of online texts requires two different skills: confirming the credibility of more credible online texts and questioning the credibility of less credible texts.

2.4 The association between basic reading skills and online reading comprehension

Previous studies have provided evidence to support the expectations that critical online reading task performance aligned with offline reading skills (Forzani, 2018; Kiili et al., 2018; Marttunen et al., 2021). For example, it is suggested that reading fluency could positively predict students' evaluation performance (Hämäläinen et al., 2021), and students' vocabulary skill is associated with their authority judgment (Walsh-Moorman & Hovick 2021). Kanniainen et al.'s study (2022) found that reading comprehension was a strong predictor of learners' ability to conduct online research and comprehend the information they found online. In other words, students who had stronger reading comprehension skills were better at using online resources to learn. This is consistent with previous research studies (eg, Coiro, 2011; Leu et al., 2015), which also found that reading comprehension is an essential skill for effectively learning from online resources. That is, learners who have good reading comprehension skills are better equipped to navigate the vast amount of information available online and make sense of it in a meaningful way.

Furthermore, Kanniainen et al.'s study (2022) also found that reading comprehension was associated with all separate component skills of online reading comprehension skills except for locating information. This means that reading comprehension was linked to skills, such as evaluating information, synthesizing information, and summarizing information. However, the ability to simply locate information online did not seem to be significantly related to reading comprehension due to the simulated online environment employed in the test.

2.5 Gender difference in reading performance

One of the individual difference variables related to reading proficiency is gender differences. The strengths of girls in reading have been cross-culturally recognized in international assessments, such as the Reading Literacy Study of the International Association for the Evaluation of Educational Achievement (Elley, 1992), the Progress in International Reading Literacy Study (e.g., Mullis et al., 2012; Mullis et al., 2007), the Program for International Student Assessment (Stoet & Geary, 2013, 2015) and IEA's International Computer and Information Literacy Study (ICILS) (Fraillon et al., 2020).

Data from previous PISA assessments have revealed that girls outperformed boys in reading (OECD, 2010c). This gender difference was observed in all participating countries and Finland was one of the countries with the widest gender gap in reading (OECD, 2010c). In PISA 2018 assessment, the size of this gender difference has been narrowed in several countries but widened in Finland (OECD, 2019). According to the result of PISA 2018, Finnish girls outperformed boys by more than 50 scores in reading assessment.

While the gender gap in print reading has received great attention, there is growing evidence that girls and boys also differ in digital reading performance. In the 2009 PISA digital literacy test, in which 19 countries participated, gender differences in electronic reading have been found in 18 countries. Girls still reported higher performance in online reading. But this gap was smaller than the gap they had in print reading. This might be because the amount of time boys spent on video games improved their performance in digital reading (OECD, 2019). Especially on the task of retrieving information, the boys' performance was close to that of the girls (Roe & Taube, 2003).

Girls also performed better than boys in digital reading according to national assessments. The US NAEP (National Assessment of Education Progress) sample assessment of Technology and Engineering Literacy stated that girls in grade 8 scored higher than boys in ICT in both 2014 and 2018 (NCES, 2016a,b;). In Australia, year 6 and year 10 female students outperformed year 6 and year 10 male students in triennial sample assessments of ICT literacy in certain years (ACARA 2018). In the ICILS conducted in 2013, it was reported that students' computer and information literacy (CIL) achievements were in relation to gender. The average score for girls was statistically significantly higher than that of boys in most countries (Fraillon et al., 2014). Similar results were found in the 2018 ICILS assessment: girls' results were consistently higher than boys' in achievement in information literacy and ICT (Fraillon et al. 2020).

ICILS report also revealed gender differences in using ICT (Fraillon et al. 2020). Female students tended to use general ICT applications marginally more and to learn more about CIL-related content at school. They are more willing to use digital resources to locate information or use digital sources to communicate information for learning-related activities while male students are less likely to use ICT for academic purposes.

Several studies have shown that girls and boys may also differ in evaluating online information sources. Forzani (2018) noticed that girls had better performance in evaluating online material than boys. This is aligned with Taylor and Dalal's (2017) study, in which female college students showed a higher ability to discern information than their male counterparts, and male students tend to have less skepticism about search engine results. Further, a study found that boys generally perceive Wikipedia as a valuable resource for collecting information and appeared to be more confident in their ability to evaluate the quality of Wikipedia entries than girls, and they may be more likely to rely on their own judgment when assessing the credibility of sources (Lim & Kwon, 2010).

In contrast to the above-mentioned findings, some studies have shown that gender is not a reliable predictor of reading performance (Manu el at., 2021; McGeown et al., 2012; Voyer & Voyer, 2014) and critical online reading ability (Marttunen et al., 2021). That is, the differences in reading behavior are not necessarily based on gender alone. Rather, individual factors, such as prior knowledge (Walsh-Moorman & Hovick, 2021; Forzani, 2018), academic

achievement (Marttunen et al., 2021) and epistemic justifications (Hämäläinen et al., 2021) can also play a role in how boys and girls evaluate online resources.

There are several reasons that attempt to explain the gender difference in reading. Some researchers believe that biological differences between males and females may contribute to their different levels of language proficiency. For example, girls tend to have faster maturation (Dwyer, 1973) which may make it easier for them to learn to read. Others suggest that faster processing speed in cognitive activities (Palejwala & Fine, 2015) helps girls have better verbal abilities and language skills, explaining the advantages observed in reading development. In addition, researchers have found that the gap between adolescent girls and boys in processing speed was larger than in other age groups (Camarata and Woodcock, 2006). By contrast, Arnett et al. (2017) found that males have slower and more variable processing speed, which may explain the gender difference in dyslexia. Besides, research also suggests that more boys experience reading impairments than girls and that boys are more likely to be identified with reading difficulties (Snowling et al., 2016; Wheldall, & Limbrick, 2010), such as dyslexia and attention disorders, implying gender-related neurological factors (Halpern, Beninger, & Straight, 2011) may affect learning ability and reading skills. Additionally, some researchers have noted that there may be a cultural bias in the way reading difficulties are identified and diagnosed, which may contribute to the overrepresentation of boys with reading impairments (Anderson, 1997). Others suggest that socialization plays a role (Plante et al., 2013), with girls being encouraged to read more than boys from a young age. This could be due to differences in parental attitudes towards reading or the types of books and media that are marketed towards each gender.

Another widely discussed reason for gender gap in reading is reading engagement. Reading engagement refers to a person's willingness and interest in reading, and studies have found that girls tend to be more engaged in reading than boys, which may explain their higher reading ability. One reason for this difference is the attitude towards reading, which have been found to have association with reading achievement (Askov & Fischbach, 1973; McKenna et al., 1995). Girls tend to view reading more positively (Logan & Johnston, 2009), and have more positive competence beliefs for reading activity than boys do (Eccles, Jacobs, & Harold, 1990), which makes them more likely to engage with

reading and language tasks. As OECD report commented, ‘The large gender gap in reading is not a mystery: it can be attributed to differences that have been identified in the attitudes and behaviors of boys and girls (OECD, 2010c, p. 99).’ Additionally, reading frequency plays a role in reading engagement. Girls tend to read more frequently than boys, which increases their exposure to reading materials and may explain why they develop stronger reading skills. In contrast, poor readers tend to read less and are not as engaged in reading (Mol & Bus, 2011; Sainsbury & Schagen, 2004), which may explain why some boys struggle with reading. Reading pleasure is also proposed as a part in reading engagement, with girls reporting to read for pleasure more than boys (e.g., Artelt et al., 2013; OECD, 2010d) and boys reporting to have lower motivation and interest in reading (Marinak & Gambrell, 2010; Mucherah & Yoder, 2008). As 42% of the gender effect on reading comprehension was mediated by reading pleasure (Chiu & McBride-Chang, 2006), it can be concluded that reading pleasure plays a significant role in the gender difference observed in reading achievement. This difference in reading interest also reflects the different levels of reading motivations of boys and girls. Less time spent on reading during free time indicates an absence in reading motivation (Moffitt & Wartella, 1991), leading to boys’ lagging from girls in reading.

In addition, boys do not perform as well as girls on school related activity and spend less time on homework than girls (Gersherson and Holt, 2015). A study indicated that boys have a four times higher likelihood of delaying their academic tasks and represent a disproportionate percentage of disciplinary actions, accounting for most of all school suspensions and disciplinary measures (Wiens, 2006). This may result in them being less academically skilled than girls, which contributes to the difference in reading achievement (Gersherson and Holt, 2015).

3 RESEARCH QUESTIONS

While research has shown that there may be gender differences in reading performance, there is evidence to suggest that girls and boys may differ in specific skills. Driven by previous studies, the purpose of this study is to examine the potential gender difference in students' basic and critical online reading skills. Basic reading skills in this study refers to reading fluency and reading comprehension, while critical online reading skills refers to credibility evaluation skills. Additionally, this study aimed to investigate the association of the two types of reading skills and, further, whether there is a gender difference in the strength of these associations.

In conclusion, my research questions were:

1. Are there gender differences in sixth graders' basic and critical online reading skills (i.e., credibility evaluation skills)?
2. How are students' basic reading skills associated with critical online reading skills? And are there any differences in the strength of associations between girls and boys?

Given the gender differences found in previous studies, I expected that the gap between girls' and boys' performance on basic and online reading tasks skills would be present favoring girls (e.g., Mullis et al., 2007, Fraillon et al., 2020). And based on previous findings, I also expected that basic reading and critical online reading skills are positively associated (e.g., Forzani, 2018; Kiili et al., 2018). Because of the lack of previous evidence, I did not set any assumptions in terms of the strengths of these associations. By exploring these research questions, this study seeks to contribute to the literature on gender difference in reading ability.

4 METHOD

This study is part of the project Educating Critical Online Readers (No. 324524) funded by the Academy of Finland.

4.1 Participants and context

The study included a total of 274 students who were enrolled in the sixth grade of basic elementary education in Finland. The mean age of the participants was 12.45 years (*SD* = 0.32). Of the participants, 52.9% were girls, 44.5% were boys, and 1.8% identified as "other" gender. Most of the students (90.9%) were native Finnish speakers and 7.6% of the students were bilingual speakers, who used other language than Finnish at home. Only 1.5% of students didn't speak Finnish at home. The 274 students were studying in 15 different classes. Over 50% of participants (118) in the study had at least one guardian with a bachelor's degree, and most guardians completed college or vocational training. This suggests that the majority of the guardians of the sample had relatively high levels of education. In Finland, 44% of the students have a guardian with a bachelor's degree or higher (Official Statistics of Finland, 2020). This indicated that in comparison to the national level, the guardians of the students recruited in this study have slightly higher educational backgrounds.

All Finnish students are taught according to the national core curriculum which is an important developmental tool in the Finnish school system. The curriculum serves as an administrative guideline and establishes aims for all subjects. The basic education core curriculum was renewed in 2014 (National core curriculum for basic education, 2014). The revised curricula identify seven areas of cross-curricular competence for primary education. Multiliteracy is listed as one of the transversal cross-curricular competencies. It enables students to comprehend various modes of cultural communication and to interpret, produce, and make judgments across a variety of texts. In this learning process,

information evaluation is critical for students to use multiple resources effectively and participate in modern communication in the digital age.

4.2 Measures

4.2.1 Reading fluency

Reading fluency was measured with a time-limited word chain test (Holopainen, et al., 2004). The test consisted of 25 word chains each of which contained four words written without any space between the words. Students had 90 seconds to identify as many words as possible by drawing a vertical line between the words. Students' score was the number of correctly identified words (max score 100). In the test manual, the test-retest reliability coefficient was reported to vary between .70 and .84.

4.2.2 Reading comprehension

A reading comprehension test from the Finnish validated test battery YKÄ (Lerkkanen et al., 2018) was used to measure students' comprehension skills. The reading comprehension test for seventh graders were used. Students were tasked to read the text entitled "Suomen kalliomaalaukset" that focuses on Finnish rock paintings and is two pages in length. To complete the comprehension test, students were asked to read the text thoroughly and answer 12 questions. Of these questions, 11 were multiple-choice questions with four options and students were asked to circle the correct option. One additional comprehension question asked students to sequence eight statements in the order they appeared in the text by writing down the numbers in the brackets. Students were allowed to continue using the text while answering the questions.

The comprehension questions examined the extent to which students understand the text and measured their linguistic and analytical skills. Based on the test material, the students were asked to accurately generalize the meaning, identify the main idea or theme of the passage, and pay attention to the supporting details and facts. They also need to show the ability to obtain the meaning of a word or phrase according to the contest. Students were credited one point of each correct response, and the maximum score of the test was 12

points. The assessment was examined for reliability and the Cronbach's alpha was .66.

4.2.3 Credibility evaluation task

The Critical Online Reading Research Environment (CORRE) was used in this study to create a critical online reading task based on web functions and thus, assess students' ability to evaluate online information (Kiili et al., 2023). Students were required to evaluate the credibility of four online texts on the topic of the health effects of sugar to complete the task. They need to read each web page carefully and answer the questions related to it.

In the task, students were given the instructions by a fact-checker named as Max when doing the tasks. Once students have answered all the questions, they needed to use the responses to rank the texts based on their reliability (Killi et al., 2023). A critical eye and the ability to evaluate the information presented are important to successfully complete this task.

As shown in Figure 1 which presents the interface of the CORRE, students can see both the interface of article (displayed on the left side of the screenshot) and the questions (displayed on the right side of the screenshot) at the same time. In addition, while working on the tasks, students would receive instructions from a fact-checker, Max (see Figure 1), who would also go through the texts and assign them a ranking. In the end, students can compare their text rankings with Max's to see if they have arrived in the same order (Killi et al., 2023).

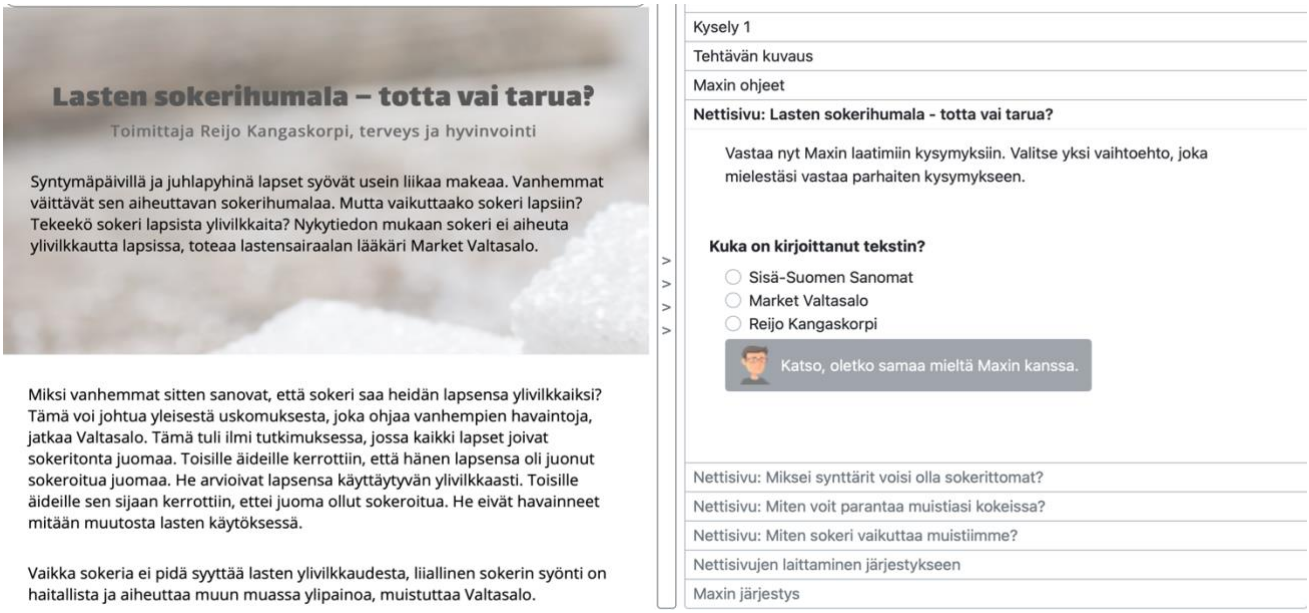

Figure 1. Screenshot of the task interface

4.2.3.1 Text materials

The research team created the four texts used in this study (Kiili et al., 2023). The texts were written in different genres, but with the same length (110–119 words) and structure. Blog text, newspaper article, popular science article, and commercial text were the four genres represented. Each text contained a question-framed title, three paragraphs, one to three images, and the main claim in the same position.

Two of the articles focused on sugar and hyperactivity in children, while the other two discussed how sugar affects memory. The author of the *blog text* recounted an experience of witnessing hyperactivity in children, including her own child, after having too much sugar during birthday parties. The author highlights the link between sugar intake and hyperactivity in children and advises parents to limit the amount of sugary treats served at parties. *The newspaper article* written by a journalist specialized in health and well-being interviewed a doctor and debunked the belief that sugar causes hyperactivity in children, stating that current knowledge suggests otherwise. This belief is likely due to everyday perceptions that guide parents' thinking. The article also introduced a study, in which some mothers rated their children's behavior as hyperactive when told they

had consumed sugary drinks, while others did not notice any changes when told the drink was sugar-free.

The popular science text authored by a researcher specialized in human memory stated that humans need sugar, but it also discussed the negative effects of excessive sugar consumption on health and memory, mentioning that consuming too much sugar can impair memory function and accelerate brain cell aging in mice. The article recommended moderate sugar consumption to avoid such negative impacts. *The commercial text* written by a chief executive officer suggested that eating sugar before important exams can improve memory and help solve difficult tasks and cited a customer survey where many students reported that eating sugar before exams improved their memory and helped them handle the test anxiety.

Two of the four articles (the popular science text and the newspaper article) on the subtopics were more credible than the others, and they were distinguished by trustworthy source characteristics, such as the authors' expertise on the subject or sincere (benevolent) intentions, as well as evidence based on research or expert statement. The less credible texts (the blog and commercial text), on the other hand, were not written from the perspective of professionals in the field, and the authors expressed either persuasive or commercial intentions by providing arguments and evidence from their own observations or a customer survey which was not notified by research.

4.2.4 Measuring credibility evaluation skills

The questions were designed to respectively measure students' ability to question the credibility, confirm the credibility, and justify their judgment for the credibility evaluation. After reading each text, students responded to three types of items that measured their credibility evaluation skills: 1) identification items, 2) credibility evaluation items and 3) credibility justification items. To respond to the identification item, students need to locate information about the author, the claim of the text, and the supportive evidence for the claim. Identification items required the students to choose the correct answer from three choices to identify the author, the main claim, and the evidence supporting the main claim. Students were provided feedback from Max once they completed the Identification items.

This means that students whose responses differed from Max's could still assess the same authors and evidence as other students.

Credibility evaluation items required students to evaluate the expertise and benevolence of the author as well as the quality of the evidence that supports the author's claim. A six-point scale was used to measure students' evaluation performance. Their responses were graded on a scale of 0 to 2. If students rated the more credible texts 5 or 6, they would receive 2 points. If their rating is 3 or 4, 1 point would be given to the students. And 2 points were for a rating of 5 or 6. The less credible texts were scored using the reverse scoring. On the basis of students' responses two sum variables were formed: confirming the credibility and questioning the credibility. This was done because the previous studies have found that questioning and confirming the credibility of the online texts are different skills (Kiili e al., 2018 & Kiili et al., 2023). Questions for the popular science article and newspaper articles was accessed to measure students' ability to confirm the credibility, while questions for the blog and commercial texts was to measure students' ability to question the credibility. There were 6 questions each for students' ability to confirm and question the credibility, with a Cronbach coefficient of .73 and .64 respectively.

TABLE 1. The justification items concerning the blog text

Justification task	Response option
Students were asked to justify their evaluations of	I think so because
author's expertise	a. She is not an expert on health issues b. She is a mother of three children c. she has written about the issue on the internet d. She tells a lot about the effects of sugar
author's benevolence	a. His job is to tell accurate information b. He tries to show that parents are wrong c. He just wants to have a lot of readers d. He writes about the issue on the Internet
the quality of the evidence	a. She uses two published studies b. She has not conducted the studies that she tells about c. Research results are contradictory d. Research has been made by foreign researchers
by selecting one of the four justification options.	

In justification items, students were requested to choose the correct justification from 4 options to explain their evaluation (see Table 1). There were 12 questions in total and 3 questions for each online text that measured students' performance on justification with a Crobaha coefficient of .67. Students were required to justify their reasons for judging the author's expertise after they rated how much the author knows about the topic by choosing one option. And before they made justification for their judgment of the author's benevolence, they would rate how willing the author is to tell the accurate information. Similarly, they were required to judge the quality of evidence by evaluating how well the author can support the main argument in the text and choose one of the justifications from the options. For example, they might rate the author's expertise low and justify their judgment that the author does not have sufficient knowledge on the topic by choosing "She is not an expert on health issues".

After completing the above-mentioned items, students worked on the rank task by determining the order of four texts according to their credibility. Students' ratings ranged from 0 to 5. Students received a 5 if they placed the popular scientific text first and the newspaper article second in terms of credibility. If they ranked the newspaper article over the popular scientific text, they would receive 4 points. If they ranked the popular science article first and one of the less credible texts second, they would receive 3 points. And two points were for the case if they ranked the newspaper article first and one of the less credible texts second. Students received 1 point for ranking one of the less credible texts first and one of the more credible texts second. Students received no points if they chose the two less credible texts as their first and second choices. After completing the rank task, students were given an opportunity to compare their own ranking order with the ranking order of Max. This allowed the students to see how their rankings compared to an expert. By comparing their ranking order to Max's order, students could identify any discrepancies or errors in their own rankings.

4.3 Procedure

The data was collected in the 2020–2021 academic year. Researchers used Microsoft Teams to connect with the students due to the COVID-19 pandemic restrictions. The study was carried out during two lessons on different days (2 x

45 min). In the first lesson, students did the reading fluency and reading comprehension tests. The instructions were given via video. At the beginning of the session researcher also shortly explained what the study was about, that all the students in the class did the task but participation in the study (i.e., using their responses for research purposes) was voluntary. Research also told that the results of the tests did not affect students' grades.

In the second session, students did the critical online reading test. Researchers gave a brief introduction about the task at the beginning, and a short video (1 minute 49 seconds) was also provided to inform students of the task environment's elements and how to perform the task. This ensured that all the instructions were given in the same way. Then students logged on with their computers and got access to the task using a given code. After ensuring all the students started the task, the researcher muted and only communicate with the teacher via chat if necessary. The mean time spent on the task was 20 minutes and 11 seconds (*SD* = 5:31).

To ensure that any potential effects of reading order on the credibility evaluation performance, the participants were randomly assigned to two groups that were assigned different reading orders. The texts that the participants read consisted of two sub-topics, each containing one text that was more credible and one that was less credible. Group 1 read the less credible text first (sub-topic 1), followed by the more credible text (sub-topic 1), and then read the more credible text first (sub-topic 2), followed by the less credible text (sub-topic 2). Group 2, on the other hand, read the texts in reverse order. This design ensures that any potential effects of reading order are balanced across the two groups, allowing the researchers to control for the potential effects of reading order (Killi et al., 2023).

4.4 Data analyses

Data analysis was conducted for the items used in this study with SPSS (Version 29). First, descriptive statistics were calculated on the scores students received from the reading fluency test, reading comprehension assessment, and credibility evaluation task.

Then, to measure whether girls and boys differed in basic reading skills and credibility evaluation performance, I conducted t-tests for all variables with one exception as the scale of the variables was interval, and the variables were approximately normally distributed. According to the histogram, the variable confirming the credibility was skewed, and therefore, I used the Mann-Whitney U test to compare girls' and boys' performances on confirming the credibility.

To find out if students' basic reading skills are associated with critical online reading ability, I performed Pearson correlation tests to those variables that were approximately normally distributed. For associations that included confirming the credibility, I used the Spearman correlation test. To determine whether there were significant differences between the correlations for boys and girls, an online hypothesis test for comparing correlations (Lenhard & Lenhard, 2014) was used.

4.5 Ethical considerations

All research procedures employed in this study followed the ethical principles of research with human participants (Finnish National Board on Research Integrity, 2019). The informed consent was obtained both form the guardians and students. Students participated based on their own will. They received an information letter written in a simple way than the letter for the guardians so that they can understand. The letter explained the importance and aims of the research, the voluntariness of the participation, and how the results of the tasks would be used. They were assured that their privacy and confidentiality would be protected as researchers would convert the names on the task papers into codes, after which all responses would be treated anonymously. Their names would not be exposed to the public and no one would know which answers came from them. If they decided to consent to the participation, they would fill in the written consent form together with their parents or guardians. Additionally, students and parents or guardians were made aware of the freedom to discontinue the study at any moment without any explanation. They were also informed that participating in the research would not affect students' grades. Moreover, the researchers would give feedback to the teachers. This can help teachers plan their teaching in class and help students improve their online research skills.

5 RESULTS

5.1 Gender differences in basic and critical online reading skills

Table 2 shows the descriptive results on students' basic reading skills and credibility evaluation skills as well as results obtained from the comparative analysis. It can be seen that there was a statistically significant difference between girls and boys in reading fluency ($p < .001$), and the effect size is small ($d = 44$). The data indicated that girls ($M = 20.09$) scored higher on reading fluency tests than boys ($M = 17.30$) and girls ($M = 7.03$) slightly outperformed boys ($M = 6.46$) on reading comprehension test as well. However, the difference is not statistically significant, only approaching the significance. ($p = .08$), and the effect size is small ($d = .23$). It is worth noticing that the standard deviation among boys ($SD = 2.73$) is somewhat higher than among girls ($SD = 2.19$).

In terms of credibility evaluation skills, the descriptive results indicated that both girls and boys performed well in confirming the credibility but demonstrated weak skills of questioning the credibility and justifying the credibility. And, surprisingly, no evidence was found for the effect of gender on the ability to confirm credibility ($U = 7934.50$, p =.59). Girls (mean rank = 131.73) attained similar scores with boys (mean rank = 126.82). Additionally, the results showed that gender appeared to be irrelevant to boys' and girls' performance in questioning the credibility, justifying the credibility, and ranking the texts according to their credibility. None of these differences were statistically significant (see Table 2).

5.2 Examining the association between basic and critical online reading skills

The results of the correlational analysis of the basic and critical online reading skills (i.e., confirming the credibility, questioning the credibility, justifying the credibility and ranking the texts), are summarized in Table 3. The results showed

that there was a positive correlation between reading fluency and all three online information evaluation skills, but the relationship is small in magnitude. Therefore, the gender differences in the strength of this association were not examined further.

A positive correlation was found between reading comprehension and credibility evaluation abilities among both girls and boys. According to the result of the Spearman correlation test, although reading comprehension is associated with the skill of confirming the credibility, the association is weak for girls ($r = 0.19$, $n = 141$, $p < 0.05$) and boys ($r = 0.15$, $n = 117$). However, according to the Pearson correlation test reading comprehension and scores of questioning the credibility correlated moderately both in girls ($r = 0.30$, $n = 134$, $p < 0.01$) and boys ($r = 0.46$, $n = 109$, $p < 0.01$), suggesting that as reading comprehension scores increase, students' level of questioning the credibility tends to increase as well. However, according to the result of the correlation comparison (Lenhard & Lenhard, 2014), the gender difference in the correlation was not statistically significant ($z = -1.43$, $p = 0.075$) although it approached the significance.

A relatively strong association was found between reading comprehension and justifications for credibility, indicating that the higher students' reading comprehension ability was, the better students were in justifying the credibility ($r = .57$, $p < 0.01$). However, when comparing the correlation coefficient for girls ($r = .51$, $n = 134$, $p < 0.01$) and boys ($r = 0.62$, $n=108$, $p < 0.01$), I found no significant difference between genders in the strength of the correlation ($z = -1.239$, $p = .11$).

Also as predicted, reading comprehension and ranking scores were positively and moderately associated with one another for girls ($r = .46$, $n = 134$, $p < .01$) and boys ($r = .40$, $n = 109$, $p < .01$). But further statistical tests revealed that there is no significant gender difference in the relationship between reading comprehension and ranking scores ($z = 0.564$, $p = .286$), although the correlation coefficients were slightly higher for girls than boys.

In summary, the study did not find evidence to support the idea that boys and girls differ significantly in the strength of associations between basic reading skills including reading fluency and reading comprehension, and credibility evaluation skills.

TABLE 2. Descriptive statistics of girls' and boys' basic and critical online reading skills

	Girls			Boys			Total			t/U	df	p	Cohen's d
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*				
Reading fluency (max. X)	144	20.09	5.86	118	17.30	6.94	266	18.84	6.52	3.48	229.69	<.001	.44
Reading comprehension (max 12 p.)	138	7.03	2.19	114	6.46	2.73	257	6.76	2.45	1.79	214.79	.08	.23
Confirming the credibility (max 12 p.)[1]	141	10.19	1.95	117	10.13	1.87	265	10.17	1.91	7934.50	-	.59	-
Questioning the credibility (max 12 p.)	141	5.30	2.58	117	5.05	2.94	265	5.12	2.76	.71	232.61	.48	.09
Justifications for the credibility (max 12 p.)	141	6.11	2.45	116	5.95	2.84	264	5.98	2.66	.49	228.53	.63	.06
Ranking score (max 5 p.)	141	3.42	1.54	117	3.30	1.57	265	3.34	1.55	.62	256	.54	.08

Note. [1] = U-test

TABLE 3. Associations between basic and critical online reading skills

	Reading fluency		Reading comprehension		Confirming the credibility[1]		Questioning the credibility		Justifications for the credibility	
	girls	boys	girls	boys	girls	boys	girls	boys	girls	boys
Reading fluency	—									
Reading comprehension	.29**	.49**	—							
Confirming the credibility[1]	.19*	.15	.19*	.24*	—					
Questioning the credibility	.11	.14	.30**	.46**	-.16	-.12	—			
Justifications for the credibility	.25**	.33**	.51**	.62**	.19*	.23*	.47**	.61**	—	
Ranking score	.16	.10	.46**	.40**	.18*	.21*	.31**	.42**	.51**	.44**

Note. *p < 0.05, **p < .01, [1] = Spearman correlation coefficient

6 DISCUSSION

The present study focused on the gender difference in basic and critical online reading skills, particularly in reading fluency, reading comprehension, and credibility evaluation skills of Finnish primary school students. In addition, I examined the associations between basic and critical online reading skills.

Below, I will cover the key findings from my research, the study's limitations, possible directions for further study, as well as the pedagogical implications of my findings.

6.1 Gender differences in students' basic reading skills

Consistent with previous research, girls had better performance in reading fluency, which is aligned with the previous study, suggesting that girls may have been better at recognizing words accurately and quickly than boys (Thompson, 1987). In this study, girls performed slightly better in reading comprehension task, but the difference was only marginally significant. The finding is contrary to the conclusions reached through the PISA data (OECD, 2010c) and other studies (e.g., Mullis et al., 2012; Mullis et al., 2007). According to previous research, the gender gap in students' basic reading comprehension is smaller than that in reading fluency (Manu et al., 2022). In this study, the gender gap was also more pronounced in reading fluency, a more basic reading skill, but the difference in reading comprehension was not fully confirmed.

Although the link between reading fluency and reading comprehension was also found in this study (see Table 3), the gender gap reflected in the test results of reading fluency was not fully reflected in reading comprehension. In this study boys were not inferior to girls in other skills and strategies required by reading comprehension. One reason that may explain why I did not find a significant gender difference in reading comprehension is that, in this study, the questions used to test students' reading comprehension consisted mainly of multiple-choice

questions, which did not require students to write their answers. According to previous research, the gap between girls and boys in reading comprehension questions that require a written response is very clear (Berninger et al., 2008; Moll et al., 2014).

6.2 Gender differences in students' critical online reading skills

Students critical reading skills (i.e., performance in credibility evaluation task) did not differ between girls and boys. While it was previously shown that there is gender-based differences in students' online reading skills (e.g., Forzani et al., 2018; Kanniainen et al., 2019; Taylor& Dalal, 2017), I didn't find a significant difference between boys and girls in their ability to confirm and question the credibility of online information, nor in their ability to justify their judgment for the credibility. Overall, it was found that the ability of students to evaluate online information should deserve more concern as many students had difficulty discerning unreliable online information. Students may not be familiar with strategies for evaluating the source information and the quality of the evidence in the online texts. Both girls and boys struggled to question the credibility of less credible texts and their justification skills were also inadequate, highlighting the need for improving the component skills.

There are several reasons that may explain why I did not find the gender differences in reading comprehension and credibility evaluation, even though some others have done so (e.g., Forzani et al., 2018; Mullis et al., 2012; Kanniainen et al., 2019). First, in this study a convenient sample was employed as a non-probability sampling technique where individuals or subjects are chosen based on their easy availability and accessibility to the researcher, rather than through a random or systematic selection process. The sample was composed of students from classes taught by teachers who volunteered for this study. And there were an uneven representation of boys and girls in the sample, with there being 23 fewer boys than girls: it might be that some boys with lower reading skills did not want to participate in this study. Therefore, the sample may not represent the overall population and may only be applicable to the specific group of students who were involved in this study. Consequently, the data might not be representative enough to generalize these results. However, to further confirm

the absence of gender differences in credibility evaluation, additional research with a more representative sample is needed.

Another possible explanation for this undiscovered gender difference in critical online reading tasks could be that guardians of students in the sample have better academic backgrounds than the national average in Finland. This suggests that the sample may be more academically advantaged than the general population in Finland. Research has shown that parental education level is strongly associated with children's reading performance. Children of parents with higher levels of education are more likely to be proficient readers, while children of parents with lower levels of education are more likely to struggle with reading (İnce & Gözütok, 2018). It could be argued that this positive relationship was due to the home learning environment that parents from highly educated backgrounds create to benefit their children's reading performance (e.g., Chiu & McBride-Chang, 2006; Sirin, 2005). On the other hand, children of parents with lower levels of education may face greater challenges in accessing resources like books at home, which can limit their reading development. Though examining the parent's educational level was not the focus of my study, future research should investigate the role of this in students' credibility evaluation.

Third, another possible reason for the inconsistency in results between the current study and the previous studies could be explained in part by the different methods used to measure information evaluation skills. In the previous studies (e.g., Forzani, 2018; Kanniainen et al., 2022), students were asked to answer open-ended questions about how they judged the credibility of online information. In contrast, in the current study, students were asked to answer multiple-choice questions. The results of open-ended questions used in the previous studies could have been influenced by the student's level of expression in writing. As previous research has shown that girls are better in expressing themselves in writing (Reilly et al., 2018), the studies using open-ended items, could have undermined boys' skills in justifying the credibility of online information. However, it has not been determined which measure is a more effective response to students' credibility evaluation skills, the multiple-choice questions used in this study or the written responses. Future research might seek to find out how different types of tasks capture credibility evaluation skills. Further, it needs to be

investigated whether boys and girls show differences in the different types of tasks since the gender difference may be reflected by the used measures.

Forth, the voluntary teacher may have been devoted to support students with differing reading skills. The Finnish comprehensive school system has been known for its emphasis on teachers' proficiency and significant autonomy in designing and implementing their teaching practices. By providing appropriate instructional strategies and academic support through differentiated teaching, teachers can help students achieve better learning results (Thomas et al., 2013) and thus build their confidence in their abilities. Therefore, disparities between classes may arise due to the level of teaching method and the attitude of the teacher. Additionally, the Finnish education system emphasizes individualized instruction, with instructors closely collaborating with students to pinpoint their strengths and weaknesses and create unique learning plans.

Finally, reading comprehension was relatively strongly correlated with credibility evaluation skills. Although the reading comprehension skills required by offline and online reading do not exactly overlap, students are likely to use basic reading comprehension skills such as retrieving information and generalizing the author's intention and the main idea of the text when reading online texts, particularly when searching for the indicators of source features and author information. Therefore, in this study, the unconfirmed gender gap in basic reading comprehension may also contribute to the explanation of why boys and girls were at similar levels of online information evaluation skills which are key components in the online reading comprehension skill set.

6.3 Associations between students' basic and critical online reading skills

It was found that the better the student was at reading fluency and comprehension skills, the better students performed in credibility evaluation tasks. This association was found both among girls and boys. Notably, reading comprehension skills seemed to be more strongly associated with credibility evaluation skills. This is consistent with the findings of previous studies. For example, in Forzani 's study (2018), students' reading comprehension as measured by the Offline Reading Assessment (Cui, Bruner-Sedransk, &

Sedransk, 2014) was positively associated with their performance on the Web-based information evaluation.

As previous studies have stated, offline reading skills are the basis for online reading and comprehension (e.g., Leu et al., 2013) Developing offline reading skills can be beneficial for strengthening critical evaluation skills for online information. Offline reading skills are fostered in an environment with fewer distractions than online reading. This allows more engagement in deep reading and reflection on the content. These comprehension skills can thereby be applied to online reading (Killi et at., 2018) and play an essential role in online information evaluation because successful credibility evaluation requires students to not only focus on the source features but also to value the quality of the texts' statement and in some cases to integrate information from multiple sources. By practicing deep reading offline, students can learn to identify key points and arguments in a text and evaluate the validity of those points.

In addition, basic reading skills are important for online reading because they provide a foundation for the more advanced skills required to navigate and comprehend digital texts. When students can comprehend and analyse online text, they are better able to detect bias and identify logical fallacies. However, according to Afflerbach and Cho (2010), it seems that online reading comprehension is not isomorphic to offline reading comprehension. And the unique nature of the evaluation of online resources may also account for this heterogeneous relationship between online and offline reading comprehension (Killi et at., 2018).

The result of this study noted there is a correlation between reading comprehension and credibility evaluation skills but didn't provide evidence for gender difference in the strength of the correlation. One possible explanation for this lack of gender difference could be that the reading comprehension skills that can be applied to the credibility evaluation are limited and there is no tendency for either girls or boys to completely rely on these skills to cope with information assessment in the online environment. Most of the information that students come across through the print reading material has been gauged by teachers or professionals and thereby students are not required to check the authenticity and credibility of the information. As a result, traditional offline reading does not shape the habit of critical online reading. Traditional reading comprehension skills that

students can apply to the assessment of online information may be limited to the level of processing information, such as retrieving information and summarising the author's intentions and the main idea of the text. The skills of judging the reliability of information are difficult to acquire from offline reading. This means online critical evaluation ability distinguishes from traditional offline reading ability (Bråten, Strømsø & Britt, 2009) and may be influenced by other personal factors related to the online environment, such as personal stance on the internet, interest in information science (Katz et al., 2006) and computer skills and experience (Punter et al. 2017).

6.4 Pedagogical Implications

As for practical implications, it should be borne in mind that boys may need more attention on their development of lower-level literacy skills. Previous studies have revealed that more boys have literacy problems with spelling, which underlies the ability to decode words (Moll et al., 2014), and the risk of becoming the 10% percentile of lowest performers in terms of reading fluency was considerably higher for boys than for girls (Torppa et al, 2018). This noticeable gender gap is also identified by its role as a main mediator for reading achievement. According to Torppa et al.'s study (2018), the difference between Finnish girls and boys in PISA Reading can be mainly explained by their different performances on reading fluency. In addition, the association between reading difficulties and future educational choice is stronger for Finnish boys than for girls (Savolainen et al., 2008). Therefore, these points highlight the importance of fostering boys' word recognition skills. Educational interventions may be warranted to identify the causes of such deficiency in the early stage. Educators should be aware of the vulnerability of boys in basic literacy skills and give them more pedagogical support if it takes them more time and effort to read.

As this word recognition skill forms the basis of higher-level reading practice, the efforts to improve students' reading fluency may also positively affect their reading comprehension, particularly for boys who might benefit more from educational instructions aimed at improving the accuracy and speed of decoding words. Because by achieving this they can devote more cognitive resources to

comprehension skills and strategies which can be applied in both print and online reading.

However, the equipment of both literacy skills is not enough for students to meet the challenge of evaluating the credibility of information in a complex online environment (Kiili et al., 2020), especially when they confront less reliable information and disinformation that is widely disseminated. This study has shown that both girls and boys struggle with less credible online texts. They may not be able to identify the less convincing evidence or understand how the author's biases may be influencing the content. If they don't realize the importance of evaluating the validity of the arguments, they may be easily swayed by persuasive language or emotional appeals. Thus, it is necessary for them to know how to utilize various factors such as source information and the author's argument to identify the trustworthiness of online texts. To help students improve their critical evaluation skills, teachers can provide opportunities for students to practice questioning and justifying skills by encouraging students to ask questions, engage in class discussions.

Furthermore, guided practice relevant to specific component skills might also have pedagogical significance (Kiili et al., 2018). For example, by practicing skills of looking for key features helpful in the evaluation of texts and reasoning the author's purpose or intentions (Cho & Afflerbach, 2015) according to the author's statement, students can become more proficient in making informed judgments about the reliability and accuracy of the information presented. By practicing critical thinking strategies such as identifying biases and analyzing evidence, students may learn how to distinguish between high and low-quality arguments and thereby be able to recognize when information is presented in a biased or incomplete manner. By comparing and contrasting multiple texts, analyzing different points of view on the same topic, and how the same point of view is expressed and justified in different ways may be beneficial for students to gain a deeper insight into the underlying claims, arguments, and evidence presented in each text. As such, they may have a valuable understanding of the different roles that scientific research methods, surveys of the public, and personal experience play in supporting the views of articles. On the other hand, they may also learn that online articles differ in level of credibility and what makes an article trustworthy. This can help them strengthen their ability to justify the

credibility, which has been also proved to be improved in this study. Moreover, through this structured practice, students may become more aware of the characteristics of different genres of online texts such as blogs, news articles, popular science articles, and commercial writing. Additionally, their critical writing skills and communication skills may be enhanced if they get learning inspiration about how to craft persuasive messages and convey ideas effectively in various contexts.

6.5 Limitations and future directions

The first limitation was the convenient sample the study used as discussed above (section 6.2), which may have limited the generalizability of the findings. Future studies should aim to address the limitations of this study by using more representative sample. In addition, the sample in this study reported above-average guardians' educational level. Given the strong relationship between parents' educational background and students' socioeconomic status (SES), and the association between students' SES and achievement in online reading (Leu et al., 2015), the results of this study may not be representative of students from all different socioeconomic backgrounds. However, the relationship between SES and the ability to evaluate credibility was not examined further in this study, it might be investigated in the future.

Secondly, the simulated Internet environment is limited in testing students' real-life performance (e.g., see Kanniainen et al., 2022) when faced with complex online information though the controlled testing environment provides researchers with a better understanding of how students perform on component skills. When students encounter the same difficulty in evaluating authentic online information, their ability to transfer and apply the skills they learned might be constrained. Therefore, in future research, more attention should be paid to the use of these skills in daily life and to the factors that influence students' performance in the online environment, thus enhancing the authenticity of the tasks in the design of online information assessment tasks. Additionally, teaching guidance should be complemented with opportunities for students to practice their skills in real-life online environments.

Thirdly, this study did not use the written response to measure students' skills of credibility evaluation, which may provide an explanation for the reason why gender difference was not detected (cf. Killi et at., 2020). It is possible that girls and boys may have different performances on written tasks (Camarata and Woodcock, 2006, Scheiber et al., 2015), such that without including a written response component in the assessment, any potential gender differences may not have been captured. Future studies might focus on the embeddedness of written responses within the credibility evaluation task to further explore how writing interplays with component skills of credibility evaluation. Additionally, the multiple-choice questions might not have offered a complete assessment of the student's abilities as multiple-choice questions could be limited in measuring students' capacity to gauge the development of complex thought and problem-solving skills necessary for online research and learning. However, having students answer multiple-choice questions for justification after they rate the author's expertise and benevolence and the quality of the arguments used by the author will make them aware of the importance of justification to their judgment of the reliability of online information.

6.6 Conclusions

Overall, this thesis provides us with an understanding of 6th-grade students' performance on basic reading skills and online information evaluation by investigating whether girls and boys differ in the tests of reading fluency, reading comprehension, and online credibility evaluation. This understanding is important for several reasons. First, aside from reading fluency, no gender differences were found in other tests, strengthening previous findings that girls and boys differ in lower-level reading skills (Manu et al., 2022) and face the same challenge of evaluating the credibility of online texts (Marttunen et al., 2021). Understanding how gender may impact basic reading skills can help educators and parents tailor their instruction and support to better meet the needs of students. Further, the results indicated that both basic reading skills are positively associated with student's ability to critically evaluate online information. It's worth noting that a relatively strong association between reading comprehension and justification skills was examined in the present study. This can be perceived by the essential

role of comprehension skills for processing information in online text evaluation. Not surprisingly, no gender difference was detected in the association between reading comprehension and credibility evaluation skills. This implies the impact of comprehension skills on the evaluation task performance is similar for both girls and boys. However, basic offline reading skills are not enough for students to succeed in credibility evaluation given the unique nature of online reading and comprehension.

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