

Metacognitive Reflection and Digital Skills-Based Reading Training in
French Minority Language Schools

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Abstract

This study investigated students' reading performance and how it relates to the use of a digital reading training program combined with the use of metacognitive reflection. The participants were five grade 8 students, aged 13 and 14 years old, at a French minority language school in Newfoundland. The data were collected using the following instruments: a demographic questionnaire, a pre- and post-test reading performance assessment, the ELSA_{web} reading skills training program, and a metacognitive reflection questionnaire. The results were analyzed by comparing reading speed before and after the study, computing growth scores for reading comprehension before and after the study, and descriptive statistics to measure the outcomes of the ELSA_{web} training program and metacognitive reflection questionnaire. The results of the study suggest that there is a positive relationship between students' reading performance and their use of the ELSA_{web} training program simultaneously with the metacognitive reflection questionnaire. The results of the metacognitive reflection questionnaire revealed varying levels of engagement from students and demonstrated that those students who engaged more thoroughly with the metacognitive reflection questionnaire obtained more significant results. The findings of this study are informative both at the school board level and within the classroom. The findings suggest that research-based reading training interventions are effective and should be incorporated into curriculum in order to support students as they learn to read. Additionally, it suggests to teachers that metacognitive reflection is a useful tool to equip students with as they are learning and building on their new and existing skills.

General Summary

This study was interested in the potential relationships between students' reading performance and their use of a digital reading training program, while also being prompted to reflect on their use of this program. This study took place at a French minority language school in Newfoundland, with five grade 8 students (13-14 years old). The data were collected using a number of different tools, including questionnaires, reading performance assessments, and ELSA_{web} (digital reading training program). The results were analyzed by looking at the numerical difference in reading speed as well as reading comprehension before and after the study. Additionally, the outcomes of the ELSA_{web} training program and the reflection questionnaire were explained by describing trends and interesting outcomes in the data. The results of the study suggest that students' reading performance benefits from the use of the ELSA_{web} training program while also being prompted to engage in reflection. The results also seem to show that students who are more engaged in reflection show even more reading performance improvement. The findings of this study suggest that research-based reading training intervention works and should be included in curriculum, and that teachers should encourage students to engage in reflection to deepen their learning.

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Chapter One

Introduction

As classroom teachers, we are constantly seeking out ways of meeting our students exactly where they are and leading them to their potential. One of the biggest challenges in this is that we are just one person teaching a number of students, making it very difficult to understand and meet every individual student's needs. In addition to this, if we are able to understand each of our students' needs, we don't always have the specific training needed to best support their learning needs. In particular, as a middle school teacher, I don't necessarily have an understanding of how to teach foundational skills, but rather, build on existing skills.

It is becoming increasingly evident every year that students are being siphoned from one grade to the next without actually having the foundational skills needed to progress further. Notably, based on my own observations, an increasing number of students are arriving to grade 7 and are unable to proficiently read texts that have been selected and used at that grade level for years prior. My interest in this research area arose as a result of wrestling with this unbalanced ratio of teacher to students, lacking specific training on teaching foundational skills, and noticing the number of older students still needing to learn these foundational skills.

In our 21st century society, students are struggling to read and rather than focusing on intervention to solve the root problem, we are providing them with tools to perform the skill for them. This is just a band aid solution as this only carries them through their school years and they never actually master the skill of reading, a necessary skill to function in our society. In an attempt to contribute to the mass of practical literature that can help our students learn to read, this study concentrates on digital reading training intervention and how it might interact with metacognitive reflection in order to enhance reading performance.

1.1 Statement of the Problem

Put simply, reading is the process of viewing printed material and making meaning of the string of symbols that you see. Huey (1908) asserts that this is an unnatural process that once did not exist and has evolved over the course of time to a point where reading has truly become the crux of our everyday lives. We typically associate reading with academic settings, but it is in fact a skill that is needed to complete the most mundane of tasks, like reading a street sign for directions, or reading a store's weekly flyer (Huey, 1908). When reading difficulties are left unaddressed, not only does it impact a student's academic performance and success, it impacts their ability to easily engage in many tasks required of them in their adult life.

Kilpatrick (2015) posits that "reading difficulties represent one of the most common referral issues in schools" (p. xvii). This is indicative of two things. First, there are a significant number of students who struggle to read at the expected level. Second, it is imperative that schools have research-based reading programs both integrated into their curriculum and available to those who need extra support. Students being referred for extra reading support is certainly a step in the right direction to help struggling readers, however if it is followed up with inadequate intervention, the student's root problem will not be solved. There is an incredibly large body of research that exists to support struggling readers, however very little of it has made its way into our schools to help these students (Carette et al., 2009; Compton et al., 2014; Ecalle et al., 2013; Geva & Massey-Garrison, 2013; Hulme & Snowling, 2015; Kendeou et al., 2014; Kilpatrick, 2015; Kleinsz et al., 2017; Nation, 2005; Savage et al., 2007; Scarborough et al., 2001; Soto et al., 2020).

Numerous studies have demonstrated the effectiveness of specific reading training intervention, and even more specifically, digital reading training intervention (McNamara et al., 2006; Kleinsz et al., 2017; Capodiecici et al., 2020). Digital reading training intervention has the

capacity to target individual student needs, which is essential when it comes to remediating struggling readers' weaknesses (Kleinsz et al., 2017). Though results from these studies are positive and show improvements in reading performance, we continue to seek ways to make these improvements even more significant. When it comes to learning, much research has been done on the notion of metacognitive reflection and it has been shown that engaging in this level of thinking has a number of significant positive impacts on learning (Rahimi and Katal, 2012; Anderson, 2002; Klingner et al., 2011). Within the context of reading alone, many metacognitive processes, such as self-questioning and goal setting, have been identified that separate skilled readers from average or struggling readers (Anderson, 2002; Klingner et al., 2011). Knowing that metacognition and skilled reading are closely related, leads to the idea of intentionally engaging in metacognitive reflection to improve reading performance. Therefore, this study intends to understand how digital reading training programs may be related to the use of teacher-prompted metacognitive reflection in achieving increased reading performance. It will seek to answer the following question:

What is the relationship between students' use of digital reading training programs and metacognitive reflection, and their overall reading performance (speed and comprehension)?

1.2 Significance of the Study

As reading is known to be essential and takes up considerable space in curriculum, particularly in early grades, a significant amount of research exists regarding reading and how it is best learned. The findings of this study are expected to further support the notion that reading is skills-based and that these skills can be trained. In doing so, the hope is that it would encourage school systems to incorporate science-based reading programs into their curricula, consequently reducing the percentage of students who are graduating without adequate reading abilities.

Additionally, these findings might encourage teachers to fight for digital reading training programs in their schools and promote the use of metacognitive reflection in their classrooms. Finally, this study seeks to gain an understanding of the student perspective towards digital reading training programs as well as metacognitive reflection and how they feel it impacts their learning.

1.3 Organization of the Study

There are six chapters in this thesis, beginning with this introduction chapter. It is followed by chapter 2 which reviews relevant literature to conceptualize the study. This includes literature related to the reading wars and theories of reading, the types of reading difficulties which exist, the evidence behind the use of reading training intervention, and the relationship between skills training and metacognitive reflection. In chapter 3, the methodology used for this study is described and it addresses the research design, the research instruments, the participants and the recruitment process, the data collection procedure, and the data analysis. Chapter 4 presents the results of the study. In chapter 5, the results are discussed, and connections are made with the literature explored in chapter 2. Finally, chapter 6 provides a conclusion to the study and addresses the study's limitations, while also providing suggestions for future research. References and appendices are included at the end of the thesis.

Chapter Two

Conceptual Framework

2.1 Introduction

Reading is a relatively new construct in relation to human existence and it has evolved significantly over time. It began as a true privilege, and only those of a certain stature had the opportunity to learn to read (Huey, 1908). It has now become essential to our daily lives, and it is important that we are able to adequately support all students on their journey to learning to read. Much research has been conducted in this area in order to understand how to best support children as they learn to read (Apel, 2009; Castles et al., 2018; Chen et al., 2020; Dickinson & Neuman, 2001; Ehri & Wilce, 1985; Hennessy & Moats, 2020; Hoover & Gough, 1990; Kilpatrick, 2015; Scarborough et al., 2001; Torgesen & Mathes, 1998). First, this chapter calls attention to the reading wars that have plagued the teaching of reading in classrooms for decades. This study supports the phonics approach side of these reading wars and thus discusses two primary theories of reading which exist within it. Next, reading difficulties are extensively discussed, differentiating between the types of poor readers that exist. This is followed by a synopsis of digital reading training intervention, supported by specific examples. Finally, the chapter ends with an exploration of research on metacognitive reflection and its benefits when combined with the learning of skills.

2.2 Reading as a Set of Skills

When seeking to implement practices in the classroom which foster the learning of reading or reading intervention, it is essential to understand the foundations of reading. This is not necessarily an easy concept to understand as reading involves a multitude of layers of complexity that are difficult to reduce. In fact, E.B. Huey (1908), a well-known psychologist in the realm of

reading research, said that to be able to fully analyze the concept of reading “would be to describe very many of the most intricate workings of the human mind, as well as to unravel the tangled story of the most remarkable specific performance that civilization has learned in all its history” (p. 6).

As reading competence is an important element to ensure full participation in society, extensive research has been done in attempts to understand how the ability to read is acquired. This research led to what is commonly referred to as the reading wars, dating back over 200 years (Castles et al., 2018). The reading wars represent two arguments which seek to explain the process of reading acquisition: the whole-language approach and the phonics approach (Castles et al., 2018).

The whole-language approach holds that learning to read is a natural process which is acquired in the same way we learn speech (Lieberman & Liberman, 1990). It assumes that with an appropriate amount of exposure to meaningful language, children will eventually learn to read (Lieberman & Liberman, 1990). It suggests that as children are exposed to literature, they begin to guess what printed words mean using the “graphic, semantic, and syntactic knowledge” (Castles et al., 2018, p. 5) that they have acquired up to that point. The idea is that over time with more literature exposure, the reader will have an expanded vocabulary and become more accurate at guessing the meaning of printed words with their more extensive knowledge. From an instructional perspective, this suggests that teachers are simply to provide a rich literary environment and to allow students ample time to practice reading (Lieberman & Liberman, 1990). This gained rapid popularity in the classroom in the early 1980s and some of its strategies and ideas still exist within our curriculum today (Kilpatrick, 2015). Based on the significant number of poor readers that we continue to see, these strategies and concepts are not proving to be effective (Kilpatrick, 2015).

One of the major flaws of this approach is that it views the learning of speech and of reading as equivalent forms of language development. It neglects the notion that speech is a biological process which is “as old as the human species,” (Liberman & Liberman, 1990, p. 55) while alphabets are man-made and have only existed for a few centuries, demonstrating that reading and writing are not inherently biological processes. It is important to note that although Liberman & Liberman (1990) have been cited above to explain the whole-language approach, they were indeed proponents of the phonics approach as discussed below.

In contrast, the phonics approach posits that children do not innately have an awareness of how the alphabet letters map to sounds, an essential requirement for reading, and thus explicit instruction is necessary (Liberman & Liberman, 1990). The National Reading Panel (2000) examined the evidence provided by a number of studies in order to compare the reading performance effects of phonics instruction and non-phonics instruction for children with reading difficulties. Phonics instruction focuses on “helping children acquire knowledge of the alphabetic system and its use to decode new words, and to recognize familiar words accurately and automatically” (National Reading Panel, 2000, pp. 2-90). Further discussion on the alphabetic principle can be found in Section 2.2.2. Ultimately, the National Reading Panel (2000) found that “systematic phonics instruction makes a bigger contribution to children’s growth in reading than alternative programs providing unsystematic or no phonics instruction” (p. 2-92).

By the early 2000s, as demonstrated by the National Reading Panel, sufficient research had been done to reveal “a strong scientific consensus around the importance of phonics instruction in the initial stages of learning to read” (Castles et al., 2018, p. 6). This should mean that the reading wars can end, however, much of the research knowledge has not made it into policy and curriculum (Castles et al., 2018).

This study stems from the phonics approach as it breaks reading down into its component skills as opposed to looking at text as a whole. There are a number of component skills which underlie the ability to read related to notions of semantics, syntax, phonetics, and others which are explored further in Sections 2.2.1 and 2.2.2. The component skills-based view focuses on two widely supported theoretical models which are used to explain the science of reading: the Simple View of Reading and Scarborough’s Rope (Gough & Tunmer, 1986; Hennessy & Moats, 2020; Hoover & Gough, 1990; Scarborough et al., 2001, Tunmer & Chapman, 2012). These models allow us to identify reading skills which can be isolated and trained in order to improve reading performance. Both models will be explained in further detail in the following sections.

2.2.1 Simple View of Reading

In essence, the Simple View of Reading breaks reading comprehension into two components. These two components are decoding, or word recognition, and linguistic comprehension (Hennessy & Moats, 2020). Gough & Tunmer (1986) showed how using these components, reading comprehension can be defined as the multiplicative product of decoding and linguistic comprehension, as follows:

$$\text{Decoding (D) X Linguistic Comprehension (L) = Reading Comprehension (R)}$$

One of the most important intricacies of this equation “is that both decoding and linguistic comprehension are necessary for reading success, neither being sufficient by itself” (Hoover & Gough, 1990, p. 128). Hennessy & Moats (2020) illustrate this using absolute values of 0 or 1 to represent proficiency in both decoding and linguistic comprehension. Any value less than 1 would mean the reader has some difficulty in the area while a value of 0 would mean the reader has no proficiency in the area. As the equation that represents the Simple View of Reading is

multiplicative, if either factor is 0, the product will be 0 . This validates that although the two components are separable, both are required for reading comprehension (Hoover & Gough, 1990). It is for this reason that the equation is not additive. As long as one of the values is 0, no matter what increases in skill occur in the other component, proficient reading will not be possible (Hoover & Gough, 1990).

In order to fully understand this model, it is important to define both components and their product. As mentioned, decoding is also known as word recognition, and Hoover and Gough (1990) define it as “the ability to rapidly derive a representation from printed input that allows access to the appropriate entry in the mental lexicon” (p. 130). The ability to decode accurately and efficiently relies on the reader having a number of skills including phonological, orthographic and morphological awareness, as well as rapid automatized naming (Hennessy & Moats, 2020). These are all word-level skills and are explored in further detail in the reading difficulties section.

The second factor, linguistic comprehension, refers to deriving meaning from words, otherwise stated as “the ability to understand language” (Hennessy & Moats, 2020, p. xxviii). To separate this component from decoding, this is commonly measured via listening assessments as opposed to reading print (Tunmer & Chapman, 2012). When a reader is expected to read print and then convey its meaning, that would be considered the product: reading comprehension. This involves the ability to “derive sentence and discourse interpretations,” while relying “on graphic-based information arriving through the eye” (Hoover & Gough, 1990, p. 131). Tunmer and Chapman (2012) explain this reading comprehension as the process of mapping print to the reader’s existing lexicon of spoken language.

Based on this view, poor reading comprehension is caused by one of three scenarios: “(a) when decoding skill is adequate but linguistic comprehension is weak, (b) when linguistic

comprehension is adequate but decoding skills is weak, or (c) when both decoding and linguistic comprehension skills are weak” (Hoover & Gough, 1990, p.132). These three scenarios are explored extensively in Section 2.3.

2.2.2 Scarborough’s Reading Rope Model

Although the Simple Reading View is called simple, each of its components are quite complex. It does not necessarily fully identify all the complexities of the two components, but Scarborough’s Reading Rope model provides further insight into the specific skills involved in both decoding and linguistic comprehension. This is a visual model, shown in Figure 1, which includes a language comprehension rope and a word recognition rope, each composed of their own underlying skills, represented by the threads of each rope (Hennessy & Moats, 2020). These two ropes then intertwine creating one skilled reading rope which Scarborough et al. (2001) define as “the fluent execution and coordination of text comprehension and word recognition” (p. 98). Extending this metaphor, for a reader who does not struggle in either of the two components, the threads of the ropes and the two ropes themselves would be tightly intertwined leading to a strong skilled reading rope. While, in contrast, a struggling reader would have certain parts of the rope which are fraying, depending on the skill that they struggle with, ultimately impacting the overall strength of the skilled reading rope (Hennessy & Moats, 2020).

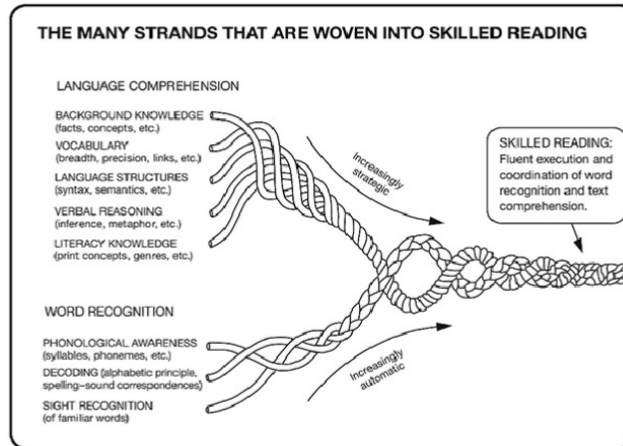


Figure 1: Illustration of the many strands that are woven together in skilled reading.

(Scarborough et al., 2001, p. 98)

The word recognition rope is composed of “three independent yet interrelated skills that translate into instructional components of effective reading instruction” (Hennessy & Moats, 2020, p. xxx). These skills are phonological awareness, decoding, and sight recognition. In order to have the capacity to accurately and automatically recognize words, the reader must possess these three skills as they are all essential to the word recognition process. However, if a reader is struggling with word recognition, these three skills can be isolated and trained individually in order to improve overall reading performance.

Phonological awareness, in particular, has been shown in many studies to be “a powerful predictor of future reading achievement,” and that “children who lack this linguistic insight are likely to be among our poorest readers” (Blachman, 2000, p. 185). This is encouraging as the skills-based approach tells us that this skill can be isolated and trained. Thus, research has shown improvements in phonological awareness lead to improvements in the skills that underlie proficient reading (Blachman, 2000; Hennessy & Moats, 2020).

Phonological awareness is simply defined by Torgesen & Mathes (1998) as “the ability to notice, think about, or manipulate the individual sounds in words” (p. 2). The human brain is wired to learn spoken language fairly easily and subconsciously with appropriate exposure (Torgesen & Mathes, 1998). However, to learn to read, children must consciously break down words into their individual segments, or sounds, called phonemes (Torgesen & Mathes, 1998). This requires children to “focus on the underlying phonological structure of the spoken word, not the word's meaning” (Blachman, 2000, p. 183). This would include abilities such as rhyming, co-articulating, and sounding out words (Torgesen & Mathes, 1998). In both the English and French languages, the spelling of words follows the alphabetic principle which holds that “our written symbols (letters or graphemes) systematically represent the smallest meaningful speech elements (phonemes) that make up the pronunciation of a word” (Scarborough et al., 2001, p. 97). An understanding of this alphabetic principle is essential for decoding as the reader must understand the relationship between written letters and the sounds they make (Scarborough et al., 2001). It is important to note that not all words follow the alphabetic principle and thus a reader must be able eventually to rapidly recognize familiar words by sight, in addition to having the ability to decode (Scarborough et al., 2001). It is incredibly important to practice the aforementioned skills from a young age as research has shown that phonemic awareness and letter knowledge are “the two best school-entry predictors of how well children will learn to read during their first 2 years in school” (National Reading Panel, 2000, p. 2-1).

As discussed earlier, word recognition is essential to reading but it alone is not sufficient. In considering the language comprehension rope, it is important to note that its skills can be broken down into language-based and cognitive processes (Hennessy & Moats, 2020). Language comprehension begins with the language-based skills which entails making meaning first at the

word-level followed by the sentence-level (Hennessy & Moats, 2020). These processes would include the skills of the vocabulary and language structures strands of the Reading Rope. Then, once that text has been read and meaning has been extracted, the reader engages the higher-level cognitive processes involved in extending understanding such as the incorporation of background knowledge (Cain & Oakhill, 2007). Further to that, a skilled reader will verify their understanding as they read, engaging in the cognitive process of comprehension monitoring (Cain & Oakhill, 2007). Background knowledge, verbal reasoning, and literacy knowledge are the Reading Rope strands which are considered cognitive processes. These two groups of skills are necessary when reading as texts are made up of both a microstructure and macrostructure (Hennessy & Moats, 2020). Microstructure refers to what you see on the page, “the exact words and sentences (syntax) chosen by the author to convey meaning” (Hennessy & Moats, 2020, p. 15i). Macrostructure, on the other hand, is a “hierarchy of idea units that contribute to the overall structure of the text,” (Hennessy & Moats, 2020, p. 15j) that allow us to identify underlying meanings and overall themes. When viewing text as being made up of micro- and macrostructures, we use our language-based processes to interpret the microstructure while we use our cognitive-based processes to interpret the macrostructure. Using these processes simultaneously, a proficient reader can “aggregat[e] successive units of meaning,” (Hennessy & Moats, 2020, p. 15j) and construct a reliable mental model of the text “by intertwining background knowledge and experiences with this text-based representation” (Hennessy & Moats, 2020, p. 15j).

The Reading Rope model allows us to deepen our understanding of the complexities of reading comprehension. It highlights how all the strands, each representing specific skills, are intertwined and operate interactively, yet they can each be considered independently in order to identify a reader’s shortcomings (Scarborough et al., 2001).

2.3 Reading Difficulties

As reading is an essential life skill and “the ability to read well is also strongly predictive of economic well-being,” (Kleinsz et al., 2017, p.45) it is imperative that as educators we prioritize the development of reading skills. In the classroom, it becomes evident very quickly that students have varying levels of reading abilities and that some students are reading below grade level, those which we would likely identify as poor readers. In order to appropriately help these students to develop their reading skills, we must have an adequate understanding of the difficulties and obstacles that may hinder them, and we must realize that “not all poor readers present the same types of reading difficulties” (Kleinsz et al., 2017, p.45). Kilpatrick (2015) compares the development of reading skills to a track meet and our goal should not be to help students become better hurdlers but rather to “[remove] the hurdles from the track before the race even starts” (p.1).

As discussed in Section 2.2, the *Simple View of Reading* posits that reading has two components, word decoding and language comprehension, and if either or both of these components is impaired, it will result in a poor reader (Kleinsz et al., 2017; Geva & Massey-Garrison, 2012). Poor readers can be organized into three subgroups: poor decoders, poor comprehenders, and general poor readers. Poor decoders are those with word reading difficulties while poor comprehenders are those with language comprehension difficulties (Kleinsz et al., 2017). The general poor readers subgroup includes those with difficulties in both aforementioned areas and the readers’ issues may be caused by several factors (Kleinsz et al., 2017). Figure 2 below shows the relationship between the three types of reading difficulties.

		Language Comprehension	
		Strong	Weak
Word Reading	Strong	Typical Reader	Hyperlexic
	Weak	Dyslexic or Compensator	Mixed Reading Difficulty

Figure 2. Types of Reading Difficulties Organized Under the Simple View of Reading.

(Kilpatrick, 2015, p. 54)

2.3.1 Difficulties with Word Reading

A poor reader that has difficulty with word-level reading can be referred to as a poor decoder. Poor decoders demonstrate “difficulty in developing word-level reading skills despite adequate instructional opportunities” (Kilpatrick, 2015, p. 54). When using the term word-level reading, we are referring to a reader’s ability to accurately pronounce a word, whether familiar or unfamiliar (Kilpatrick, 2015). Their language comprehension is intact but have poor word-level reading skills, meaning that reading an age-appropriate text themselves would be difficult for them to comprehend, however if the same text were read to them, they would be able to comprehend (Kilpatrick, 2015). Once a poor decoder has been identified, they would need specific intervention to remediate their difficulties and this intervention should be based on an understanding of the obstacles that poor decoders face.

As children learn to read, they progress through different stages with varying defining characteristics. There has been some debate on the role of visual processes in reading and whether a visual deficiency could be the cause of difficulty for a poor decoder. However, Ehri & Wilce (1985) identified three stages of reading development in which only the first stage, the prereaders, used solely visual cues. It is important to note that prereaders are not actually reading words but rather recognizing how they look, and it is not until a child “shift[s] from visual to phonetic cue

processing” that they can “begin reading their first words reliably” (Ehri & Wilce, 1985, p. 172). Once this shift occurs that moves them into the second stage, the difficulties faced by poor decoders become evident and they “often get ‘stuck’ in the second level and never develop proficiency at the third” (Kilpatrick, 2015, p. 92). This supports the idea that these readers are generally experiencing with issues with phonological processing such as phonological awareness, rapid automatized naming, or word recognition, rather than the syntactic or semantic issues associated with poor comprehension (Å Elwér et al., 2013; Geva & Massey-Garrison, 2013).

During the first stage of reading development, “children learn letter names and letter sounds,” (Kilpatrick, 2015, p. 91) and once they reach the second stage they begin phonic decoding where they use their acquired letter-sound knowledge along with phonological blending to read and learn new words. In stage two, the alphabetic principle, defined as “the insight that there is a direct connection between the sounds of spoken language and the letters in the written words,” (Kilpatrick, 2015, p. 93) plays a role in reading acquisition. Poor decoders do not necessarily have this insight and if they do, they are unable to apply it very efficiently (Kilpatrick, 2015). Without an understanding of the alphabetic principle, these readers “face the difficult task of learning these arbitrary meaningless associations” (Ehri & Wilce, 1985, p. 175) between letters and sounds, ultimately straining the capacity of their memory. With these weak letter-sound skills, it is difficult for these readers to continue in the phonic decoding process which requires the letter-sounds to be blended (Kilpatrick, 2015). This is where poor decoders begin to rely on visual cues stored in memory to compensate for their difficulties in deciphering the word, leading to inaccuracies (Ehri & Wilce, 1985). The final step of the phonic decoding process is the pronunciation of the word, and according to the self-teaching hypothesis¹, after a few exposures the word can be stored in

¹ A well-supported theory that “proposes that once children become somewhat proficient at phonic decoding, they can teach themselves to read” (Kilpatrick, 2015, p. 95).

long-term memory, ultimately developing the reader's automaticity in word recognition (Kilpatrick, 2015). It is therefore reasonable to expect that a reader who struggles with the first step of the phonic decoding process will end up with a limited number of words that they can automatically recognize.

The final stage of reading development focuses on the growth of the sight vocabulary through the process of orthographic mapping: the process of words becoming stored in long-term memory (Kilpatrick, 2015). For a reader to complete this process efficiently, they must have good letter-sound skills and good phonemic analysis skills (Kilpatrick, 2015). Given that issues with these skills are faced in stage two, it is evident that a poor decoder would have difficulty ever accessing this stage of reading development without intervention. When encountering a new word, a normally progressing reader would not only be able to blend the letters to sound it out, but also be able to break it apart and use memory of previously encountered words to understand the connection between the phonemes in order to “map the pronunciation of that spoken word onto its printed spelling” (Kilpatrick, 2015, p. 98). As a reader begins to orthographically map more and more words, they build their sight vocabulary and can apply phonic rules from their memory to new words (Kilpatrick, 2015). Due to the complexity of this orthographic mapping process and the phonological awareness skills required to accomplish it, poor decoders have much difficulty developing their sight vocabulary and are consequently encountering novel words all the time. This is a costly cognitive process, leaving few resources for higher-order comprehension skills. Without intervention targeting phonological awareness skills, poor decoders will have great difficulty becoming proficient stage three readers.

2.3.2 Difficulties with Comprehension

While a poor decoder has difficulty with word-level reading, a poor comprehender has sufficient word-level reading abilities but has difficulty comprehending the meaning of what they are reading or what is being read to them (Kilpatrick, 2015). Hulme & Snowling (2011) describe a poor comprehender as one that “can read aloud accurately and fluently at a level appropriate for their age but fail to understand much of what they read” (p. 139). This means that in a classroom setting, poor comprehenders often go unnoticed as their reading abilities appear to meet grade-level expectations (Hulme & Snowling, 2011). These readers may also be referred to as hyperlexics meaning their “word-level reading skills [are significantly] above their level of comprehension” (Kilpatrick, 2015, p. 134), but for the purpose of this study these readers will be referred to as poor comprehenders. These types of readers will need specific intervention that targets the underlying issues of their comprehension deficit in order to become better readers.

As we read, we are performing multiple operations simultaneously in order to achieve our ultimate goal of comprehending the text. These operations include word recognition, use of relevant background knowledge, making inferences, identifying important details, making connections, and using a variety of reading strategies (Kilpatrick, 2015). As readers, we have “limited attentional, metacognitive, and working memory resources available” (Kilpatrick, 2015, p. 134) and thus if one of the aforementioned operations requires additional resources, it will hinder reading comprehension. There are several language difficulties which could be the cause for poor reading comprehension and these difficulties are often present prior to having the ability to read (Hulme & Snowling, 2011). Some of the more commonly researched areas in regard to language difficulties include semantics, syntax, background knowledge, working memory and attention-allocation (Kilpatrick, 2015).

As mentioned, poor comprehenders have sufficient word recognition abilities which is an essential skill for reading, however, they will struggle to read if they have issues accessing semantic and syntactic word properties (Müller & Hagoort, 2006). It is in this step of the reading process that a reader is able to “construct a meaningful message from a string of words” (Müller & Hagoort, 2006, p. 84). Some poor comprehenders have been shown to have poor lexical-semantic skills meaning that they have good verbal skills however they struggle to make meaning of vocabulary that is not part of their day-to-day lexicon (Kilpatrick, 2015; Nation, 2005). In school, as broader, subject-specific texts are introduced, students with weak lexical-semantic skills will have difficulty assigning meaning to new vocabulary (Kilpatrick, 2015). Furthermore, looking at sentences as a whole, some poor comprehenders have poor syntactic and grammatical knowledge, meaning they struggle with how words should be ordered in a sentence (Kilpatrick, 2015). A typical reader can read a text with nonsense words and still be able to answer comprehension questions because they have knowledge of where particular word classes belong in a sentence. A reader with poor syntactic and grammatical knowledge cannot make sense of the text because they cannot identify which word class particular words belong to and the relationships between words in a sentence. Generally, readers with these grammatical difficulties also have semantic difficulties, however, many readers with semantic difficulties do not have deficits in syntactic and grammatical knowledge (Kilpatrick, 2015).

Arguably the most essential key to comprehension is the knowledge that the reader brings to a text (Nation, 2005; Catts, 2009; Kamhi, 2009). In fact, Catts (2009) argues that “understanding what we read actually involves more the modification of the knowledge that we already have than the collection of new knowledge” (p. 178). With that in mind, without bringing any knowledge or very little knowledge to the reading of text, there is nothing or very little to modify. Additionally,

research has shown that poor comprehenders “not only lack sufficient general background knowledge, but they also fail to apply the background knowledge they do possess” (Kilpatrick, 2015, p. 138). As we read, we use our background knowledge and the text we are reading to create a dynamic situation model in order to organize, and ultimately comprehend, the information (Kilpatrick, 2015; Nation, 2005; Catts 2009; Compton et al., 2014). Building this model is not easy and uses up some of our attentional resources; however, over time, a typically developing reader becomes skilled at building these models and it becomes a relatively subconscious action (Catts, 2009). Conversely, “poor comprehenders seem to have a more difficult time constructing a situation model,” (Kilpatrick, 2015, p. 139) likely due to the limited amount of background knowledge available (Compton et al., 2014). There is also evidence that a larger knowledge base could “reduce the demands put on working memory” (Compton et al., 2014, p. 64), another area which is shown to be the cause of reading difficulties for some poor comprehenders.

Much of the research on reading difficulties has found a relationship between poor reading comprehension and working memory, but there is some disagreement on the nature of the working memory deficits (Carretti et al., 2009). Carretti et al. (2005) looked at what is required of a reader when comprehending a text and focused on the idea that “the reader is continuously required to ... maintain the important information and eliminate the irrelevant information” (p. 47) in memory. If the reader is unable to do this or is inefficient in this process, they will likely misinterpret what they have read. Carretti et al. (2005) explain delayed intrusions as items that are required to be remembered for a period of time but later become irrelevant, however the reader does not remove it from the working memory. It was found that poor comprehenders had more difficulty updating information in working memory and they “made more delayed intrusions ... suggesting that [they] had difficulty in controlling information that was no longer relevant” (Carretti

et al., 2005, p. 56). Upon conducting a meta-analysis of studies looking at the role of working memory in poor comprehension, Caretti et al. (2009) were able to conclude “that the [working memory] deficit of poor comprehenders relates mainly to those tasks requiring storage and processing of information while inhibiting off-goal information and/or updating memory content information” (p. 250) when completing complex tasks. On an even simpler level, when reading, “one needs to temporarily capture and maintain the specific words and grammatical constructions in memory in any given sentence or group of sentences in order to comprehend that information” (Kilpatrick, 2015, p. 140). It has been shown that poor comprehenders struggle to connect pieces of information that are not within close proximity of each other, making it difficult to create meaning of novel vocabulary and concepts (Kilpatrick, 2015). This hinders the development of a reader’s vocabulary which has already been shown to negatively affect language comprehension.

Comprehending written text requires attention, however, like working memory, this resource is limited. Attention-allocation is defined as “the ability to adapt attentional and processing resources to the demands of the task at hand” (Kendeou et al., 2014, p. 12). Generally, with more reading practice, the ability to focus our attention on important elements becomes more efficient, however this is not the case for some poor comprehenders (Kendeou et al., 2014). Readers who struggle with attention-allocation are easily distracted by details and have difficulty identifying the main idea of a text, which becomes more obvious as texts become more complex (Kendeou et al., 2014). This makes the comprehension monitoring process difficult which is a strategy used by readers to ensure they understand what they are reading (Kilpatrick, 2015). Lacking the ability to identify and retain important information results in less accurate construction of situation models, which has been shown to be essential in comprehending written texts (Kendeou et al., 2014).

The skills that have been discussed are all essential in allowing the reader to engage in higher-order thinking and achieve meaningful understanding of written texts. Weakness in any of these areas causes the limited amount of resources available to become exhausted, which, in turn, has an impact on overall comprehension, not allowing the reader to have adequate or accurate information to identify main ideas, make inferences, or monitor understanding (Kendeou et al., 2014). This suggests that poor comprehenders require intervention targeting the specific skills underlying language comprehension.

2.3.3 General Reading Difficulties

As demonstrated through the Simple View of Reading, reading comprehension is the product of word recognition and language comprehension. A deficit in either of those two factors results in difficulties with reading comprehension. After having explored both poor decoders and poor comprehenders separately, we look at the general poor reader. This is a reader who struggles with both decoding and comprehension and as such, would require intervention targeting the needs of both poor decoders and poor comprehenders. It can be difficult to distinguish a poor decoder from a general poor reader. A reader who struggles with word recognition may not appear to comprehend what they are reading, but this does not necessarily mean they have comprehension deficits. The verbal efficiency hypothesis asserts that “decoding and comprehension share a fixed amount of cognitive resources. Thus, the more resources are devoted to decoding, the less there are available for comprehension” (Kleinsz et al., 2017, p. 46). Essentially, when a poor decoder is using the majority of their cognitive resources to decode, there is very little left to use for comprehension purposes, resulting in what appears to be a general poor reader.

This can be difficult to discern as ultimately their issues at the word-reading level hinder their overall comprehension as well. It is expected that with appropriate and targeted intervention

these poor decoders can overcome these obstacles allowing them to read and comprehend text simultaneously.

It is important to note that these deeply rooted difficulties in reading will not go away with time and practice, as is seen in higher level classrooms where many students are still not reading at their grade level (National Reading Panel (US), National Institute of Child Health, & Human Development (US), 2000). Kleinsz et al. (2017) state that “reading difficulties are not likely to decrease spontaneously,” (p. 47) demonstrating the necessity to provide all poor readers with specific and targeted early intervention.

2.4 Reading Training Interventions

As addressed previously, reading is an essential life skill and there remain considerable amounts of children who fall behind their classmates in reading performance year after year. In fact, the Organization for Economic Cooperation and Development (2016) found that “about 20% of students in OECD countries, on average, do not attain the baseline level of proficiency in reading. This proportion has remained stable since 2009” (p. 4). With results such as these, it is imperative that education systems adopt evidence-based reading curriculums and are able to offer struggling students the intervention they need to have success in reading. As seen in Section 2.2, the scientific evidence points to a phonics approach to learning to read which is grounded in the idea that reading is made up of component skills that can be individually trained (Scarborough et al., 2001). A number of reading training intervention programs have proven to be effective for readers with difficulties, however, in order to be most effective, the training must target the individual reader’s weakness (Kleinsz et al., 2017). For example, based on a meta-analysis, Kleinsz et al. (2017) suggests that “programs designed to encourage decoding abilities have a) to focus on phonological skills and grapho-phonological correspondences, b) to take place

individually or in small groups, and c) to be explicit, repetitive and provide positive feedback” (p. 46). What will become evident to a teacher immediately, is that meeting these requirements for every student, each with their own point(s) of weakness, is a near impossible task. Fortunately, many digital reading training intervention programs have been developed which are able to meet these requirements in real-time.

There are a number of advantages to using digital reading programs, the first being that it is a format that students are familiar with. Much of the reading that is done for both adults and children occurs on a digital device such as a computer, e-book or tablet (Capodieci et al., 2020). Thus, it makes sense that students would practice reading in a similar way, preparing them for future reading. Additionally, a computer is able to recognize the reader’s knowledge and skills in real-time, and can adapt the content in order to “mov[e] the student towards their potential” (Campbell et al., 2022, p. 8149). With multiple students in a classroom, this is an invaluable feature to meet the different needs of each student. The results provided from these programs can also be used by the teacher as formative assessment and they can integrate the needs of the students into their lessons (Campbell et al., 2022).

Next, digital learning can lead to increased motivation (Campbell et al., 2022). This motivation can stem from a number of places. If the program uses gamification, for example, students may consider the reading training as something they do for fun (Campbell et al., 2022). These programs can also provide feedback and encouraging notes which may motivate the student to continue training on the program (Kleinsz et al., 2017). Also, due to the fact that the program can adapt to their individual needs, the training can be more enjoyable and lead to less frustration, especially for struggling readers, in comparison to reading in a regular classroom setting (Capodieci et al., 2020).

Finally, the use of a digital reading training program allows the student to both see and hear the print on the page. It has been shown that “the bimodal (e.g. oral and visual) presentation of a word can increase word recognition by improving the mapping between orthographic and phonological word representations” (Kleinsz et al., 2017, p. 46). It also allows beginning readers or poor decoders, who are unable to easily access the print visually, to engage in reading and listening comprehension (Kleinsz et al., 2017). Several studies have shown that a digital reading program allows a teacher to reach more students more efficiently and effectively, and also obtain concrete results regarding skill levels.

As students get older, they experience a shift in their purpose for reading. As young children they are learning to read, but in later grades they begin reading to learn (Campbell et al., 2022). This means that the texts they encounter become more complex and include more novel vocabulary, requiring a strong reading foundation (Campbell et al., 2022).

A digital reading program that has been developed to help students handle these increasingly complex reading demands is called iSTART, the “Interactive Strategy Trainer for Active Reading and Thinking” (McNamara et al., 2006, p. 147). This program has a goal of “helping adolescent readers learn strategies, and improve their comprehension of science text” (McNamara et al., 2006, p. 148). The basis of this program is the identification of strategies that skilled readers use that poor readers do not so that these strategies can be explicitly trained to poor readers. It is based specifically on Self-Explanation Reading Training (SERT) (McNamara et al., 2006). The research has shown that “students who self-explain text are more successful at solving problems, more likely to generate inferences, construct more coherent mental models, and develop a deeper understanding of the concepts covered in the text” (McNamara et al., 2006, p. 149). The response to this would seemingly be to get poor readers to self-explain texts, however, many are

unable to self-explain effectively so they do not benefit. iSTART trains the student in adopting reading strategies that will allow them to effectively self-explain texts (McNamara et al., 2006). These strategies include “comprehension monitoring, paraphrasing, prediction, elaboration, and bridging” (McNamara et al., 2006, p. 150). There are multiple different phases of the training, feedback is provided immediately, and the program adapts in real-time based on the student’s performance. One of the studies using the iSTART program found that both strong and poor readers benefitted, but in different ways. For weaker readers, their results on text-based questions improved, while for stronger readers, they saw more success in making inferences. This is an expected result as a reader needs a foundation of comprehension before they are able to go further and make inferences about a text (McNamara et al., 2006).

Another study which was conducted by Kleinsz et al. (2017), focused on the use of specific computer-based training programs based on the readers’ points of weakness. They began by first sorting the poor readers into the three subgroups: poor decoders, poor comprehenders and general poor readers (Kleinsz et al., 2017). The general poor readers were randomly assigned to either the poor decoder or poor comprehender group to create two groups. Those in the poor decoder group worked with the Chassymo program which “encourages grapho-syllabic word processing” (Kleinsz et al., 2017, p. 49). The student hears a syllable, sees the syllable, then hears a word containing that syllable and must identify in what part of the word that syllable occurs (Ecalte et al., 2013). They are exposed to a predefined bank of words each containing two to three syllables and the program provides immediate corrective feedback (Ecalte et al., 2013). The students in the poor comprehender group worked with the LoCoTex program which “promotes two aspects of text comprehension ... : Literal and inferential comprehension skills” (Kleinsz et al., 2017, p. 49). This program consists of three modules, each increasing in complexity as it begins with identifying

information explicitly stated in the text to answering questions based on inferences (Kleinsz et al., 2017). Corrective feedback is provided in each of the modules (Kleinsz et al., 2017). Overall, in the Kleinsz et al. (2017) study, it was found that “the grapho-syllabic training led to improved performance in written word recognition, while the comprehension training improved listening and reading comprehension,” (p. 54) which was the anticipated result. An interesting finding was that, in general, those trained in decoding did not see significant improvement in reading comprehension while those trained in comprehension did see improvements in overall reading performance (Kleinsz et al., 2017). This supports the idea that readers can benefit from training in the multitude of skills involved in reading and not only their point of weakness (Kleinsz et al., 2017).

Although only a couple digital reading training programs have been explored here, there are many more and a number of studies have been conducted to understand their effectiveness. Capodieci et al. (2020) share a consolidated table of a number of programs and their components and efficacy which can be consulted for further insight into digital reading training programs.

2.5 Skills Training and Metacognitive Reflection

As has been seen throughout this literature review, there have been numerous studies conducted in an effort to better understand reading and identify how to better assist students in learning to read. Many of these studies have explored the impacts of the use of metacognitive strategies on reading comprehension. In fact, Rahimi and Katal (2012) state that “metacognitive knowledge characterizes the approach of expert learners to learning, it enhances learning outcomes, facilitates information recall, comprehension of written texts, and the completion of new types of learning tasks and improves the rate of progress in learning and the quality and speed of learners’ cognitive engagement” (p. 76). To better understand the meaning of this statement, it

is essential to have a strong understanding of metacognition and how it differs from cognition. Metacognition can simply be defined as “thinking about thinking,” (Klingner et al., 2011, p. 220) but more intricately explained as “an awareness of cognitive processes, related tasks and strategies, as well as an ability to regulate cognitive processes to plan, monitor and assess one’s understanding and performance” (Teng & Reynolds, 2019, p. 3). Alternatively, cognition relates to the processes we use to “achieve specific goals,” (Klingner et al., 2011, p. 221) such as the processes we engage in determining the meaning of a word. Klingner et al. (2011) demonstrate how closely metacognition and cognition are intertwined using the following example:

We use our metacognition to monitor whether we comprehend what we are reading. If we get to a word we do not understand, we then try a cognitive strategy to help us figure out what the words means, such as using our knowledge of prefixes and suffixes. Then we step back, figuratively speaking, to see whether the text now makes sense [via metacognitive strategies]. (p. 221)

There are a number of metacognitive strategies which can be employed before, during and after reading. Before reading, the reader can prepare and plan by determining a purpose for their reading (Anderson, 2002). This allows the reader to “develop a plan to guide their reading and to activate their background knowledge, and it helps them to sort out pertinent information” (Klingner et al., 2011, p. 223). In engaging in these metacognitive processes, the reader is better equipped to understand the text as they read. During reading, a proficient reader selects learning strategies they can use, monitors the use of those strategies, and orchestrates the use of various strategies simultaneously (Anderson, 2002). In order to select the most effective strategies, the reader has to think about which strategies would be best based on the context of their reading (Anderson, 2002). Once they make those selections, they continuously have to reflect on the strategies they have chosen and ensure they are still using the strategies to help them meet their reading goals, and ultimately ensure they are comprehending the text (Anderson, 2002). Finally, the reader should be

able to use and coordinate a number of strategies while reading. Anderson (2002) states that “[t]he ability to coordinate, organize, and make associations among the various strategies available is a major distinction between strong and weak second language learners” (p. 4). Once the text has been read, the reader engages in the metacognitive process of “evaluating strategy use and learning” (Anderson, 2002, p. 4). In this stage, the reader begins to reflect on what their original purpose of reading was, what strategies they used, how well they used them, and whether or not they met their purpose of reading (Anderson, 2002).

A number of specific strategies exist to answer these questions. For example, self-questioning is where the reader asks themselves questions about the text to verify their understanding (Klingner et al., 2011). Another example would be question stems where the reader is provided with a templated question where they must fill in the blanks of the question based on the text they read (Klingner et al., 2011). Often, students do not develop these strategies on their own, but rather need to be shown how to use them by their teacher. For example, a signal word strategy which encourages students to think about the 5 Ws and an H (who, what, when, where, why, how) (Klingner et al., 2011). A teacher may first introduce this strategy by associating visuals with each of these signal words (Klingner et al., 2011). Over time, the student learns how to use such a strategy without needing the additional prompts. Engaging in these reflective processes allows the reader to identify their strengths and weaknesses and provides feedback for their next encounter with printed text.

The reflection process also falls under the umbrella of self-regulatory learning, which involves “a process of self-generating thoughts, ideas, feelings, and actions for attaining one’s learning goals” (Teng & Reynolds, 2019, p. 3). The primary difference between self-regulation and metacognition is that “self-regulation also depends on self-beliefs and affective reactions, such

as doubts and fears, about specific performance contexts” (Zimmerman, 2000, p. 14). Research has shown that, as teachers, we should be enabling and preparing students to self-regulate their learning to enhance their reading performance (Teng & Reynolds, 2019). If students are not given explicit opportunities to self-regulate their learning, they may not develop the tools needed to take ownership of their learning, and “may not be able to evaluate their learning, which may cause repeated experiences of failure” (Teng & Reynolds, 2019, p. 2). These self-regulatory and metacognitive processes are “crucial for learners selecting and activating strategies and it is important that teachers strive to develop students’ own metacognition and teach them how to use strategies that they find effective for the kinds of tasks they need to accomplish” (Rahimi & Katal, 2012, p. 74).

Reflection can be “defined as an individual’s capacity to apply prior experiences to improve subsequent performances in a goal-directed and effective manner” (Jonker et al., 2012, p. 225). When asking students to reflect on their learning, they can be provided with either a generic or a directed prompt (Davis, 2003). Generic prompts essentially just ask the student to write down what they are thinking about the learning task they have just completed (Davis, 2003). Alternatively, a directed prompt provides more direction on what exactly the student should think and write about, but it is still relatively open-ended to ensure students are still able to express their own interpretation (Davis, 2003). Directed prompts are especially useful for students with weak existing metacognitive abilities or those learning to engage in reflection (Davis, 2003). Providing prompts has the potential to “help learners expand knowledge about their learning strengths and weaknesses, utilize appropriate strategies in assessing their learning, and draw causal inferences as to why progress was or was not being made” (Teng & Reynolds, 2019, p.4). Teng & Reynolds (2019) showed that students who received metacognitive prompts showed more improvements in

reading comprehension than those students who did not receive prompts. Without reflective prompts, students may not feel as though they have control of their learning, and likely remain at the surface level of a text, and resort to guessing to draw conclusions (Teng & Reynolds, 2019). In guiding students through this process of reflection, teachers “enabl[e] students to become more independent, autonomous, and lifelong learners” (Rahimi & Katal, 2012, p. 74).

When considering the component-skills approach to reading, the concept of reading can be analogous to the concept of sport, as competency in both areas is based on the development and enhancement of skill. Metacognition is also highly researched in the world of sports, particularly in the context of elite athletes striving to reach professional levels. Jonker et al.’s (2012) study explored the role of reflection in elite youth athletes’ performance improvement, built on Zimmerman’s (2000) self-regulation research. As discussed earlier, Zimmerman (2000) too breaks down the self-regulatory process into before, during, and after phases, namely forethought, performance or volitional control, and self-reflection. These three phases exist cyclically as they feed into one another after each performance as shown by Figure 3.

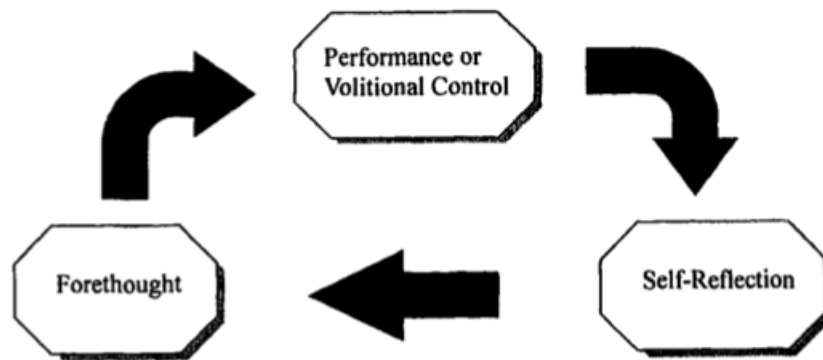


Figure 3. Cyclical Phases of Self-Regulation. (Zimmerman, 2000, p. 16)

Focusing on self-reflection, Zimmerman (2000) views this as having two processes: self-judgment and self-reaction. Self-judgment evaluates the result in comparison to the goal and identifies causes

and areas of improvement, while self-reaction is more about the learner's subjective satisfaction with their performance (Zimmerman, 2000). In the context of sport performance, athletes engaged in reflection compare their performance to their competitors', determine what made their performance a success, make decisions on what is necessary for improvement, and more (Jonker et al., 2012). Jonker et al. (2012) provide the following example to help visualize the steps of an athlete's self-reflection:

Soccer player X is selected for the under 19 international youth selection (i.e., junior international level in the year before transition) based on his current capacities. He is tall, strong, and has a good kick, but is less technical and fast. He knows that he has to score more goals if he wants to become selected for the 'real' Dutch soccer team next year. Based on his capacities (i.e., tall, strong, good kick) he decides that his chances to score more goals are biggest when he starts practicing on his free kick. From now on, he arrives early at training to practice and stays after training to refine his kick. At home, he keeps on training his accuracy. Furthermore, he monitors whether this strategy results in attainment of his goal: score more goals during games to become selected for the Dutch soccer team. (p. 226)

Jonker et al. (2012) posit that using reflection in this way on a consistent basis "during the talent years [12-18 years] seems beneficial in realizing one's full potential as an athlete" (p. 227). Their study found that "junior athletes who attained senior international status displayed more frequent use of reflection during their years as juniors" (Jonker et al., 2012, p. 236). This was found even though the athletes all had similar hours spent training, which implies that training based on reflection was more effective (Jonker et al., 2012). There were a number of interesting, more detailed findings of this study, all leading back to the effectiveness of reflection combined with sport-specific skills training (Jonker et al., 2012).

Coming back to the context of reading, we see how employing a digital skills-based training intervention and combining it with direct prompts to foster a reflection process, may lead to more significant reading performance gains. Assisting our students in engaging further in their

own process of learning to read has the potential to develop more competent readers in our classrooms as “the result of scholarly work shows that those learners who take conscious steps to understand what they are doing and use a greater variety of strategies tend to be the most successful learners” (Rahimi & Katal, 2012, p. 78).

Chapter Three

Methodology

3.1 Introduction

This chapter presents the methodology that was used to determine whether the act of metacognitive reflection combined with training in a reading skills program in French for language learners in French first language programs leads to gains in reading performance. This chapter outlines the methods and procedures used, which includes the research question, research instruments, participants and method of recruitment, data collection procedure and the tools and methods used for data analysis.

3.2 Research Question

The goal of this study is to better understand how the act of metacognitive reflection is related to training in a reading skills program in French for language learners in French first language programs. As a language teacher who has noticed deficits in many students' reading abilities, I wanted to investigate within my classroom whether skills training and metacognitive reflection can impact reading performance. This study addressed the following question:

What is the relationship between students' use of digital reading training programs and metacognitive reflection, and their overall reading performance (speed and comprehension)?

3.3 Research Instruments

The data for this study were collected using five different instruments: the demographic questionnaire, the pre- and post-test reading performance assessment, the ELSA_{web} reading skills training program, and the metacognitive reflection questionnaire.

3.3.1 Demographic Questionnaire

The demographic questionnaire (see Appendix D) was designed to obtain a better understanding of each student's background. It included basic demographic questions such as gender and age, but also asked questions about language background and reading background. The language background questions asked students to identify their perceived first language as well as questions regarding language comfort level, language spoken in the home, the age at which they learned French, and whether or not the students speaks any other language. These language background questions provide a more thorough understanding of the students' French language capacities. Although the study took place in a Francophone school, many students did not perceive French to be their first language. Additionally, for many bilingual students, it can be difficult for them to identify what their first language truly is.

The reading background questions asked students about the last book they read, when they read it, whether they chose to read it or not, what their favourite type of book is, and their preferred language for reading. These reading background questions provide insight into the students' views on reading and the language that they typically choose to read in also provides insights into their French language abilities.

3.3.2 Pre- and Post-Test Reading Performance Assessment

Reading performance (comprehension and speed) was evaluated at the beginning and end of the study through an online measure comprising six authentic texts of varying lengths, ranging from 64 to 190 words. The measures were administered via the online platform *Pavlovia* (Pavlovia, 2023) and the texts used, and questions posed can be found in Appendix E and F. The first text was the shortest and each text got longer as the participant progressed through the order. The included texts were representative of a variety of genres but were of similar level of difficulty

regarding their complexity and vocabulary. The instrument measures both reading speed by recording the time between key clicks indicating when the participant starts and finishes the passage, as well as reading comprehension through the correct answering of the comprehension questions.

Students were instructed to read at their normal pace. Once a student finished reading a text, they were to click any key and the next screen prompted them with a comprehension question in order to assess their explicit comprehension of what they had just read. The questions asked students to identify what the text was about and they were provided with three options, with only one option being the correct answer.

This was the research instrument used in order to calculate scores for reading speed and comprehension at the beginning and end of the study. From this pre and post test measure, growth scores for students' level of reading speed and comprehension were calculated.

3.3.3 ELSA_{web} Reading Skills Training Program

ELSA_{web} (AFL, 2015) is grounded in research conducted at the *Institut National de la Recherche Pédagogique* and was developed in France by the *Association Française pour la Lecture*. Previous studies on ELSA_{web} have shown that students training with this program see significant gains in their reading performance (comprehension and speed) (e.g., Foucambert, 2000; Foucambert, 2009; Foucambert & Bourdages, 2018).

ELSA_{web} helps learners develop different component skills that play a part in the activity of reading, using six sets or “Series” of exercises (Series T, A, D, C, E, & F). Two of these series, (Series A and Series C), deal with units smaller than a sentence. One series, (Series E), proposes exercises to work on sentence-level performance. And three series, (Series D, F and T), focus on reading short texts. Each of these Series proposes evidence-based activities that foster reading

performance improvement. The online format allows learners to access the program at their leisure and advance at their own pace, as the program adapts to each learner's abilities. Each of the series is described in Table 1 below.

Table 1: Description of series in the ELSA_{web} program

Series	Description
T	<p>Series T serves as a measure of reading speed and comprehension. Results from Series T are used to calibrate the other Series' parameters to the individual's performance. This series is based on the work of Johnson Laird (1983) on mental models and Kintsch and van Dijk (1978)'s model of text comprehension. It is further supported by recent research on language and text comprehension (Deacon & Kieffer, 2017; Gernsbacher, 1990; Graesser, 2008; Graesser et al., 2007).</p> <p>After reading a text, students answer 8 comprehension questions. Questions 7 and 8 require students to match book titles to their corresponding excerpts and descriptions.</p>
A & C	<p>In these two series, students will work with words and word segments in order to improve their automatic word recognition as well as the accuracy of the information discerned. The exercises proposed in these series are supported by a body of research on eye movement studies (Clifton et al., 2007; Rayner et al., 2006, 2011; Reichle et al., 2012; Schotter et al., 2012). These exercises target automatic recognition of words and groups of words allowing participants to refine and build on orthographic representations (Apel, 2009, 2011; Chen et al., 2020) and ultimately reading speed (Paige et al., 2012),</p> <p>In series A, students are to click their spacebar when the target word appears on the screen. There are 4 phases which increase in difficulty: full word, top of the word only, consonants only, and random placement on the page.</p> <p>Series C focuses on short and long word groups. First the word groups appear in the middle of the page and the student clicks the spacebar when their target word group appears. Then, it gets more difficult and the word groups start to appear to the left or right of a fixation point in the middle of the screen.</p>
D & F	<p>The exercises in Series D and Series F help students to progressively organize their mental representation of a text through selective information searches using both lexical and grammatical clues. These series allow participants to work on the mental mapping of texts (Fayol, 1997; Graesser et al., 1997; Zwaan, 2003, 2008) and the relationship between vocabulary and reading comprehension (Gottardo et al., 2018; Lervag & Aukrust, 2010).</p> <p>In series D, a text is split into 4 parts and the words are all blurred. Once the student clicks on one of the text portions, certain sentences become legible and the student has to find a title, a key word</p>

and a summary. In the second part of this series, the student is asked questions and they have to identify the part of the text which contains the answer.

In Series F, a text appears with many words blurred out. The student has a limited time to read the text and then they have to identify a summary, title, general keywords, and specific keywords. They are given 3 opportunities to read the text and different words become legible each time. In the second part of this series, the student has to identify words from a list which were part of the initial reading and words that were part of the subsequent readings.

E

In this series, students will engage in a cloze task where they have to fill in the blanks with missing words in a text. They can avail of individualized and explicit clues to help them complete the task. Once they determine the 12 words needed to fill in the blanks, they are all removed again, the student is provided with the list of 12 words, and they must place them in the correct spots.

Reading performance is strongly associated with success on cloze tests (e.g., De Freitas et al., 2017; Eckes & Grotjahn, 2006) and cloze tasks measure the difficulty of integrating a word into its syntactic and semantic contexts (Braze & Gong, 2017).

3.3.4 Metacognitive Reflection Questionnaire

The metacognitive reflection questionnaire was the final research instrument used and was administered through Google Forms (see Appendix G). At the end of each week of ELSA_{web} training sessions, students would access the metacognitive reflection questionnaire. The questionnaire asked the same questions for each of the six series they had completed on the ELSA_{web} program that week. In order to ensure students were answering accurately for each specified series, a short description of the series was provided to remind them what it entailed. There was a combination of open-ended and closed-ended questions. The questions asked them about their level of enjoyment of the series, how difficult they found the series, to identify both the easiest and hardest part for them in each particular series, and what they learned from the specified series that particular week. Due to the very specific nature of these questions, these would be considered directed prompts for reflection (Davis, 2003).

3.4 Recruitment and Participants

Before beginning the participant recruitment process, the research proposal was reviewed by the Interdisciplinary Committee on Ethics in Human Research (ICEHR) and was found to comply with Memorial University's ethics policy. Additionally, discussions were had between the research team and the school board to ensure the ELSA_{web} program could be incorporated into the *français langue première 8* course and to receive the board's approval for performing classroom research within one of their schools. Once approval was received from the Ethics Board in March of 2022, the school was made aware that the study would be starting in the coming months.

Prior to the ELSA_{web} program being used in the *français langue première 8* course, an initial information letter was sent home to students' parents in April of 2022 (see Appendix A). The letter outlined the basis of the thesis, described the ELSA_{web} program, how it would be incorporated into the classroom and explained its connection to the curriculum. It also indicated that after the six weeks of using the program, another letter (see Appendix B) and consent form (see Appendix C) would be sent home at which point the parent and child could choose whether to have their ELSA_{web} data used in the study. Once the information letters had been sent home, the demographic and reading background questionnaire was completed by all students.

The participants were recruited from a grade eight class consisting of nine students including one female, six male and two non-binary students. At the time of the study, three of the students were 13 years old and six students were 14 years old. These students attended a Francophone school in a minority milieu and a demographic questionnaire was completed to gain a better understanding of each student's background. Academically speaking, this class had a wide range of students, some with limited capacities in language and others with strong abilities. Parental and child consent was obtained for five students' data to be analyzed. As a result, the final

sample consisted of five children whose individual progress will be analyzed in the results section. This group consists of one female, one non-binary, and three male students with a mean age of 13;9 years old. The demographic information for each of these five students is summarized in the results section.

3.5 Data Collection Procedure

After the information letter had been sent home, the ELSA_{web} program was incorporated into the *français langue première 8* class over a period of six weeks from May to June 2022. Each week students had three self-guided 30-minute sessions on ELSA_{web} where they progressed at their own pace and picked up where they left off in the previous session. At the end of each week, there was time provided to complete a reflective questionnaire. The questionnaire was the exact same every week and included both open and closed ended questions which would prompt metacognitive reflection.

Prior to the first session, all students completed the pre-test measures in order to determine their initial reading comprehension level and speed. At the end of the six week intervention, they completed a post-test measure, designed in the same format as the pretest, in order to measure changes in reading speed and comprehension. The results of these test measures would then be used to calculate the growth scores of each student after having progressed through ELSA_{web}. Both of these tests were completed quietly on computers in class, supervised by myself and another member of the research team. The test begins with a text displayed on the screen which the participant is to read. Once they are ready, they press a key on the keyboard at which point a corresponding comprehension question will appear. They answer this question and continue to the next text until they complete the total of six texts.

3.6 Data Analysis

Three sets of data were collected and analyzed in this study: the data from the pre- and post-tests, the data from the ELSA_{web} program, and the data from the weekly reflective questionnaires.

The data from the pre- and post-tests were used to calculate differences in reading speed and comprehension between the beginning and end of the study. In order to determine reading speed, the number of seconds spent reading the passage was divided by the number of words in the passage. This resulted in a words per second reading speed which was multiplied by 60 to give a more easily interpreted words per minute reading speed. Once reading speeds were calculated for the 6 passages of each reading comprehension test, the mean reading speed was calculated for each student for the pre- and post-test respectively. In analyzing the data, I noticed certain reading speeds were exceptionally high, to the point of practical impossibility. To maintain consistency, any reading speeds which were more than 1.96 standard deviations from the mean for that student were excluded and the corresponding comprehension question was also excluded (Larson-Hall, 2015). The pre-test reading speed and post-test reading speed were then able to be compared. As there were only 6 items per assessment, removing any outliers had significant impacts on the growth score percentage. However, it should be noted that all outliers were reading speeds to the right of +1.96 standard deviations, meaning there were no instances where a result was removed due to a student slowly taking their time to read the passage. Alternatively, due to the small number of assessment items per test, instead of removing the item altogether as an outlier, it could have been deemed as not successfully completed. This method, however, also would have been a limitation to the study.

As for the reading comprehension element, growth scores were calculated. For each of the 6 passages, a value of 0 was assigned for an incorrect response to the question and a value of 1 was assigned for a correct response to the question. As mentioned, any passage where the reading speed was considered an outlier and excluded, its corresponding comprehension question response value was also excluded. Once the necessary values were excluded from both the pre- and post-test, a decimal rate value of correct responses was calculated. The growth score was then calculated by subtracting the pre-test value from the post-test value, dividing the difference by the pre-test value, and finally multiplying the quotient by 100 to determine the growth score as a percentage.

The ELSA_{web} program produces graphs to represent the results of the 10 rounds of each series. These graphs allow us to see if a student progresses as would be expected with the nature of the program. The program adapts to the user's level of success. As a user has more success, the more difficult the program becomes for the next round. As a user begins to have difficulty, the program becomes a little easier in the next round. Due to this, we can expect the curve to rise and fall from round to round. Additionally, the program also offers tutorials throughout the rounds to help students in their progression and understanding. As everyone progresses differently and with a number of other factors at play, these graphs were interpreted qualitatively, and trends were identified.

The responses for each student's weekly reflection questionnaire were collected and sorted into a spreadsheet to allow for both quantitative and qualitative analysis. Every week, for each series, the student had to assign a difficulty rating, which was scored on a scale of 1-5 with 1 being very easy and 5 being very difficult. Each student's ratings were averaged over the six weeks for each of the six series. This provided an average perceived difficulty for each series for each individual student. Each student also had to indicate whether they enjoyed each series every week.

The number of times each student said yes or no over the six weeks was added up. The remaining three questions of the reflection questionnaire were short answer questions that needed to be interpreted qualitatively. The students were asked what part of each series they found easiest and most difficult, and they were asked what they learned from the series. Their responses were analyzed and general themes were drawn out. All the analyzed data from the reflection questionnaires was organized into a table for each student.

Chapter Four

Results

4.1 Introduction

In this chapter, the data is analyzed individually for each of the five participating students. All names have been replaced with pseudonyms. Each student's section begins with a detailed summary of the demographic questionnaire that they completed at the beginning of the study. These demographics may provide further context to each students' results. This is followed by an analysis of the growth scores for the pre- and post-test reading comprehension assessment. The next subsection includes a qualitative analysis of the ELSA_{web} performance followed by a qualitative analysis of each students' answers to the weekly reflection questionnaires.

4.2 Student 1: John

John identifies as a male and was 13 years and 8 months old at the time of the study. He identified English as his first language, the language in which he is most comfortable, and the language he speaks at home. He started learning French at the age of 5 years old and does not speak any additional languages. The last book that John had read was a dystopian children's fiction novel which he had finished reading about a month prior. He stated that he does not typically choose to read in his free time, and when he does read he prefers reading in English and his favourite genres are horror and comedy.

4.2.1 John's Comprehension Test Performance

In the pre-test, John correctly answered three of the six questions giving a 50% success rate. In the post-test, he correctly answered five of six questions, however, once outliers were excluded, he correctly answered four of five, giving a success rate of 80%. These results indicate

a growth score of 60%, a significant improvement over the course of six weeks. Upon analysis of reading speed, there was limited improvement for John from the pre-test to the post-test. His average reading speed for the pre-test was 191.6 words per minute compared to 194.7 words per minute (outliers excluded) for the post-test.

4.2.2 John's ELSA_{web} Performance

John was able to complete the 10 rounds of the ELSA_{web} program over the course of the six weeks. He had the most success in series A & C, which both target word recognition skills. Even as the program adapted to his capabilities by increasing the level of difficulty, he maintained scores of above 90% for the duration of the 10 rounds in both series. He also showed significant improvement in series E where his initial reading time was 12 minutes but by round 3 his reading time was consistently under 6 minutes. In series F, which focuses on the use of lexical and grammatical clues, John's progress curve was fairly representative of what we would expect from the use of ELSA_{web}.

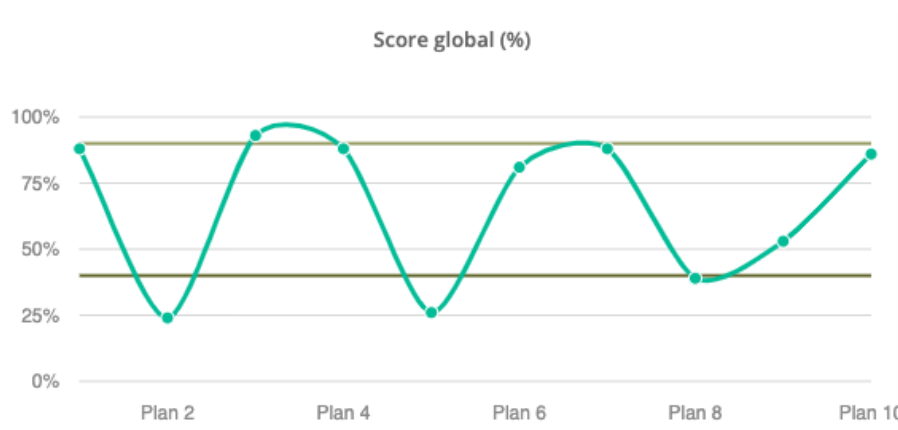


Figure 4. John's Overall Scores in Series F of the ELSA_{web} Program

As shown in the curve of Figure 4, in the first round, John didn't have too much difficulty so the program adjusted and became more difficult resulting in a lower score for John in the second round. The program then adapted again to make it a little easier and John saw more success in the

third round. This pattern continued throughout the 10 rounds creating a rise and fall in scores from round to round. By the end of the ten rounds, John finishes with a score similar to his starting score, however, by round 10, the difficulty has increased from round 1. Interestingly, in series D, which is complementary to series F, John struggled through the middle few rounds and ended up plateauing around 57% in overall score in the final few rounds.

Figure 5 shows the curves for series T, which is an overall measure of reading comprehension and speed, giving us insight into John’s overall reading improvements over the course of the six weeks. There is some improvement in reading speed from round 1 to 10 with the curve showing some ebb and flow which is to be expected due to the adaptability of the program. However, we see a sharp decline from rounds 8 to 10 of the overall score which is unlike the nature of the curve from rounds 1 to 7.

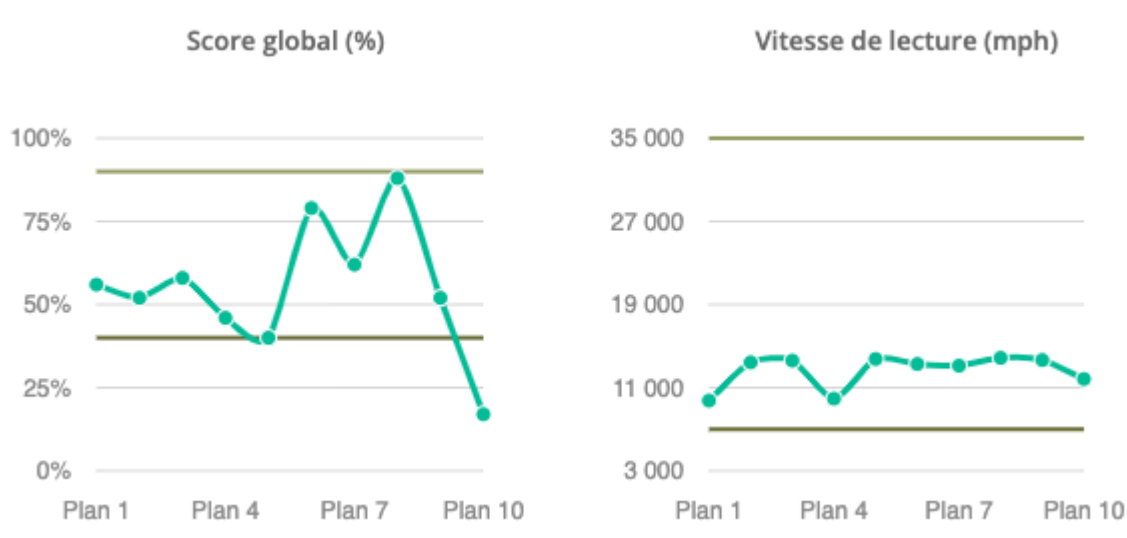


Figure 5. John’s Overall Score and Reading Speed in Series T of the ELSA_{web} Program

4.2.3 John's Reflection Questionnaire

John was able to identify the parts of each series which he found easiest and hardest. He often provided specific details on the elements of each series which were easy or hard, and occasionally specified whether or not he liked the particular element. He rarely engaged in the question asking what he learned for each series. He only answered this question five out of the total 36 times over the course of the six weeks, the majority of those times being in the first week. The table below highlights his average perceived level of difficulty (1 = very easy & 5 = very hard), whether or not he liked the series, and themes regarding what he found to be easiest and hardest.

Table 2: John's aggregated reflection questionnaire responses

Series	Average Perceived Difficulty	Enjoyed the Series?		Themes
		# of Yes	# of No	
T	2.83	4	2	He felt that the reading of the texts was fairly easy and at times he found the true or false questions about the texts he read were the easiest to answer. He consistently had difficulty with matching the title of books to provided descriptions or excerpts. In the first reflection, he stated that he learned how the series worked. He did not comment on what he learned for the rest of the reflections.
A	1.17	6	0	Overall, he found it easiest to identify when the words fully appeared on the screen. He found all three other phases of this series more difficult (top of the word, consonants, and random screen placement). He also mentioned he often got distracted or forgot the word he was looking for. In the first reflection, he said he started to learn some tricks for identifying the words that appeared. He did not comment on what he learned for the rest of the reflections.
C	2.17	5	1	He found it easiest when the words appeared in the middle of the screen. He had difficulty when the words appeared on the right or left and described it as a "nightmare". He did not state anything that he learned from this series.
D	2	6	0	For the most part, he found identifying the key word of the text to be easy. However, certain weeks this was the most difficult part for him. He found that the timer added a level of difficulty as well and felt it to be stressful. In the first week, he learned to focus on the key word options as opposed to reading the text in its entirety.

F	1.67	6	0	He felt that the texts were simple and easy to read and found it easy to identify the title. He struggled sometimes with the vocabulary used and understanding what the questions were asking. He did not state anything that he learned from this series.
E	5	1	5	He found that the second part of the series where he had to place the provided words easiest. He struggled with identifying the missing words in the first part and stated that it felt like a “guessing game” that takes a lot of tries and he did not enjoy it. In the final week he mentioned that he learned something interesting from the content of one of the texts.

4.3 Student 2: Timothy

Timothy identifies as a male and was exactly 14 years old at the time of the study. He identified English as his first language, the language in which he is most comfortable, and the language he speaks at home. He started learning French at the age of 8 years old and does not speak any additional languages. The last book that Timothy had read was a thriller fiction novel which he had finished reading about a week prior. He stated that he does not typically choose to read in his free time, and when he does read he prefers reading in English and his favourite genre is action.

4.3.1 Timothy’s Comprehension Test Performance

In the pre-test, Timothy correctly answered four of the six questions giving a 66.7% success rate. In the post-test, he correctly answered four of six questions, however, once outliers were excluded, he correctly answered four of five, giving a success rate of 80%. These results indicate a growth score of 20%, demonstrating some improvement over the course of six weeks. Upon analysis of reading speed, there was a significant improvement of 40% for Timothy from the pre-test to the post-test. His average reading speed for the pre-test was 121.6 words per minute compared to 169.7 words per minute (outliers excluded) for the post-test.

4.3.2 Timothy's ELSA_{web} Performance

Timothy was able to complete the 10 rounds of the ELSA_{web} program over the course of the six weeks. He had the most success in series A & C, which both target word recognition skills. Even as the program adapted to his capabilities by increasing the level of difficulty, he maintained scores of above 89% for the duration of the 10 rounds in both series.

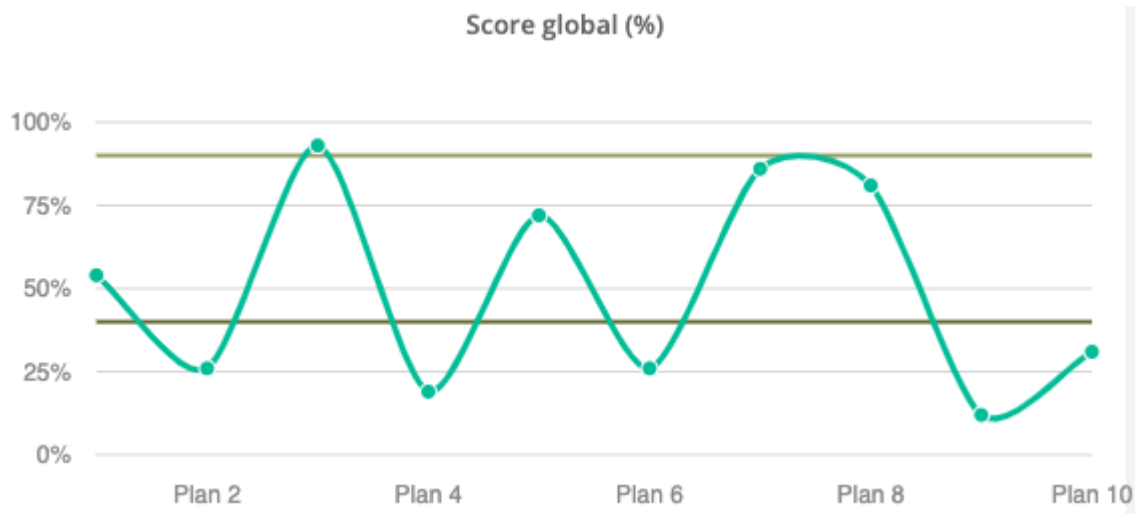


Figure 6. Timothy's Overall Score in Series F of the ELSA_{web} Program

In series F, which focuses on the use of lexical and grammatical clues, we see steep rises and declines between rounds in Timothy's progress curve shown in Figure 6. Although this curve follows the expected trajectory of the adapting ELSA program, the rounds he found difficult resulted in exceptionally low scores, ranging from 12-31%. Similarly, in both series D & E, Timothy earned some significant drops in scores for more difficult rounds. However, in both cases, by round 5 he had shifted into the expected curve where his scores reflect the adaptability of the program.

Figure 7 highlights Timothy's overall reading comprehension and speed score from series T. His speed of reading steadily increased throughout the 10 rounds. He began at a speed of 5865

words per hour (97.75 words per minute) which is below the expected range and finished off with a speed of 15 321 words per hour (255.35 words per minute) in round 8, improving his speed by almost 300%. In regards to his overall score, there were some fluctuations however his results remained fairly consistently between 40% and 60% even as the program adapted in difficulty between rounds.

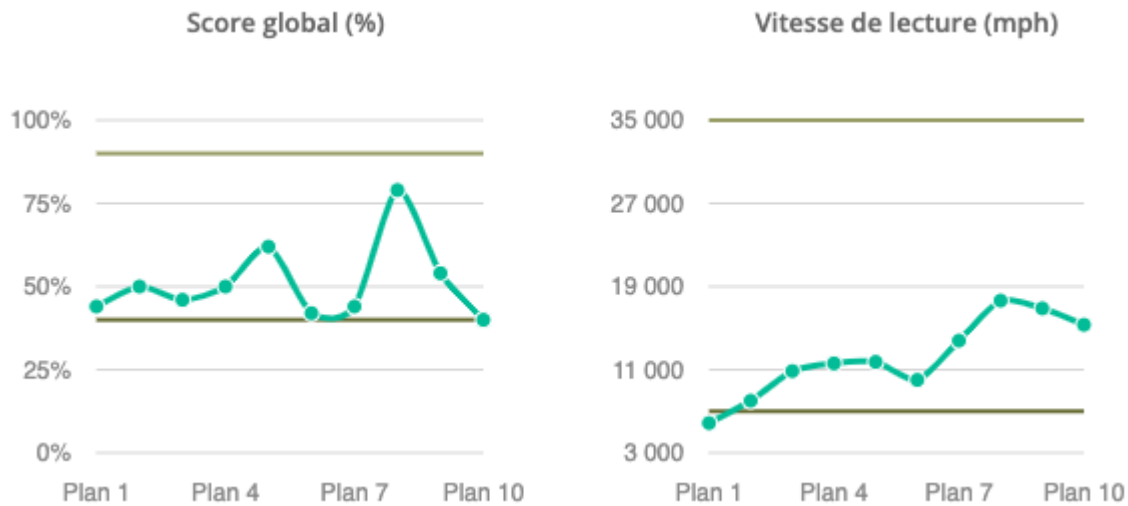


Figure 7. Timothy’s Overall Score and Reading Speed in Series T of the ELSA_{web} Program

4.3.3 Timothy’s Reflection Questionnaire

Timothy was often able to distinguish the parts of each series which he found easiest and hardest with precision. In some responses he identified very specific elements that were either easy or hard, while in others he was vague with responses such as, ‘the first part’. He often did not identify anything that he learned from each series. The majority of entries he did make were something he learned from the content of a text he read as opposed to a skill from the series itself. The table below highlights his average perceived level of difficulty (1 = very easy & 5 = very hard), whether or not he liked the series, and themes regarding what he found to be easiest and hardest.

Table 3: Timothy's aggregated reflection questionnaire responses

Series	Average Perceived Difficulty	Enjoyed the Series?		Themes
		# of Yes	# of No	
T	3.67	1	5	At the beginning, he found that reading the text and answering the questions about it was easiest. He had the most difficulty with associating the excerpts to the book titles & descriptions. However, halfway through the study, this flipped and he found the text reading & questions hardest while associating the excerpts was easiest. The only thing he stated that he learned was related to the content of one of the texts he read.
A	1.5	6	0	Overall, he felt that the first part where the full word group appears in the middle of the screen was easiest. He struggled with parts 3 & 4. In part 3, only the consonants of the word group appear and in part 4, the word group can appear anywhere on the screen. He stated that he learned to look more at the shape of the word as opposed to reading the word itself and he also mentioned it helped him learn some new words.
C	1.17	6	0	He found it easiest when the word appeared in the middle and when it was a short word group. He found it hardest when the words appeared on the left or right and when it was a long word group. He did not indicate anything he learned in this series.
D	3.33	3	3	Throughout the six weeks, he found that either identifying the summary or identifying the title of each excerpt was easiest. He generally found that identifying the keyword was the hardest part. The only things he stated that he learned were related to the content of the texts he read.
F	3.33	1	5	He often found that identifying the summary sentence was easiest and also mentioned that the third read-through was easiest. He stated that the first read-through was hardest and that it was difficult to identify all the keywords. He did not indicate anything he learned in this series.
E	4.5	1	5	Overall, he felt that the second part was easier, where he had the list of missing words and had to place them in the correct spot. In contrast, he found the first part hardest where he had to identify the missing words. The only thing he mentions that he learned is that he did not like this series.

4.4 Student 3: Melissa

Melissa identifies as a female and was exactly 14 years old at the time of the study. She identified French as her first language, the language in which she is most comfortable, and

indicated that she speaks both French and English at home. She started learning French at the age of 1 to 2 years old and does not speak any additional languages. The last book that Melissa had read was an urban fiction novel which she had finished reading about a few weeks prior. She stated that she does not typically choose to read in her free time, and when she does read she prefers reading in English and her favourite genres are drama and romance.

4.4.1 Melissa's Comprehension Test Performance

In the pre-test, Melissa correctly answered two of the six questions giving a 33.3% success rate. In the post-test, she correctly answered four of six questions, however, once outliers were excluded, she correctly answered three of four, giving a success rate of 75%. These results indicate a growth score of 125.2%, demonstrating significant improvement over the course of six weeks. Upon analysis of reading speed, there was a significant improvement of 117% for Melissa from the pre-test to the post-test. Her average reading speed for the pre-test was 40.2 words per minute compared to 87.4 words per minute (outliers excluded) for the post-test.

4.4.2 Melissa's ELSA_{web} Performance

Melissa was able to fully complete 3 of the 10 rounds of the ELSA_{web} program over the course of the six weeks. Due to the limited number of rounds completed, it is difficult to identify trends over time for the various series. She was most successful in series C which targets word recognition skills where she consistently scored in the low 80s over three rounds. In the complementary series, series A, Melissa was showing gains of about 5% from round to round and earned a maximum score of 78% in round 3. In contrast to this, in series E, Melissa's graph shows a steep negative slope spanning the 3 rounds, dropping from 63% to 30%. One of the most interesting results for Melissa is the contrast in trends for series D and F which are complementary series targeting the use of grammatical and lexical cues. Figure 8 shows that in series D she started

with stronger results but struggled more with the adapting difficulty by round 3. The curve in series F is the opposite with a weaker start but stronger results by round 3.

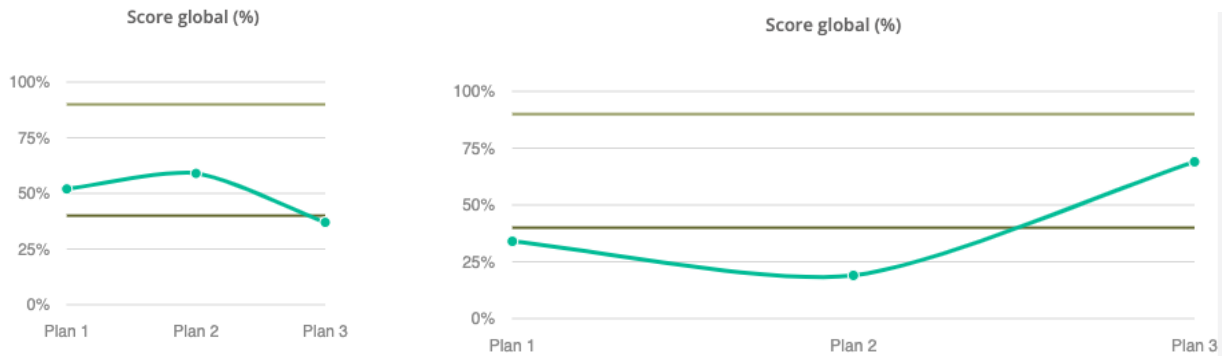


Figure 8. Melissa’s Overall Scores in Series D (left) and Series F (right) of the ELSA_{web} Program

Melissa was able to complete a fourth round for Series T. It is difficult to make any inferences about the overall scores for this series, however the reading speed results do demonstrate steady increases. Figure 9 shows an initial reading speed of 3232 words per hour (53.87 words per minute) which gives insight into why Melissa was unable to complete all 10 rounds of the program over the six-week period. However, by round 4, she was already showing improvement with a rate of 5109 words per hour (85.15 words per minute).

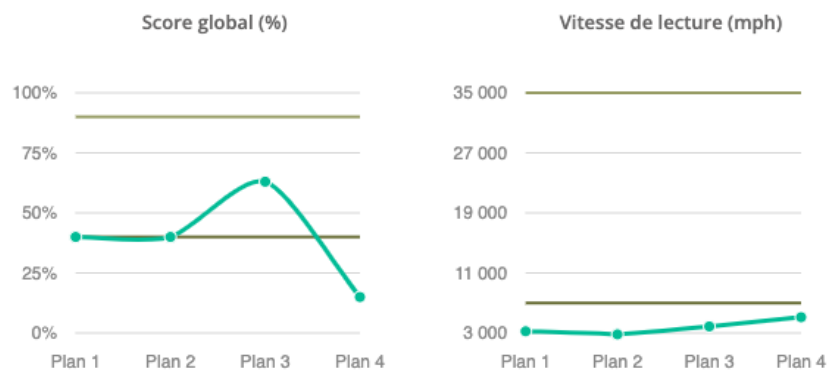


Figure 9. Melissa’s Overall Score and Reading Speed in Series T of the ELSA_{web} Program

4.4.3 Melissa's Reflection Questionnaire

Melissa only completed five of the six reflection questionnaires. She was often able to distinguish the parts of each series which she found easiest and also occasionally explained why. She engaged very well in her responses to the question asking what she learned and provided detailed responses. The table below highlights his average perceived level of difficulty (1 = very easy & 5 = very hard), whether or not she liked the series, and themes regarding what she found to be easiest and hardest.

Table 4: Melissa's aggregated reflection questionnaire responses

Series	Average Perceived Difficulty	Enjoyed the Series?		Themes
		# of Yes	# of No	
T	4.6	0	5	She found answering the questions related to the initial text she read was the easiest. She struggled to read the text and mentioned she found it hard to finish the reading in 15 minutes. Each week she mentioned she was learning how to understand the text and in the final week she stated she was learning how to pay closer attention to the text.
A	2.4	5	0	Overall, she felt that this series was easy and specifically mentioned the first part of this series being easy, where the whole word group appears in the middle of the screen. She stated that the whole series wasn't overly difficult but the fourth part where the words appear randomly anywhere on the screen was the hardest. Overall, she felt she was learning how to recognize words more quickly.
C	2	4	0	She had not yet completed this series by the end of the first week. She found this series was easy and the easiest part was when the words would appear in the middle. She found reading the words was hard, specifically when they would appear to the left or right of the fixation point, but she states it was not overly difficult. She mentions a few things that she learned with this series including memorizing the provided word, paying closer attention and recognizing words more quickly.
D	4	5	0	She consistently found that matching a title to the text excerpts was easiest. She struggled to read and comprehend the texts and mentioned it was difficult to find the key word. She states that she learned how to understand a text without reading it in its entirety and also mentioned that she learned some new words.

F	5	0	3	She had not yet completed this series by the end of the first week. She did not engage well in this portion of the reflection over the course of the 6 weeks, and only fully completed it 3 times. She does mention at one point that ‘nothing was easy’ and ‘it was all hard’. In regard to what she learned she mentions reading attentively once, but otherwise does not really engage, giving answers like ‘a lot’ or ‘reading the words’.
E	4.5	4	0	She had not yet completed this series by the end of the first week. She consistently found that reading the text was the easiest part. She mostly struggled with placing the words in the text but also had some difficulty guessing the words. She states that she learned how to pay attention to the text and how to read it well.

4.5 Student 4: Luke

Luke identifies as a male and was exactly 14 years old at the time of the study. He identified French as his first language, however noted that English is the language in which he is most comfortable as well as the language he speaks at home. He started learning French at the age of 2 to 3 years old and does not speak any additional languages. The last book that John had read was a fantasy fiction novel which he had finished reading about a month prior. He stated that he does typically choose to read in his free time, and when he does read he prefers reading in English and prefers fiction novels.

4.5.1 Luke’s Comprehension Test Performance

In the pre-test, Luke correctly answered four of the six questions giving a 66.7% success rate. In the post-test, he correctly answered five of six questions giving a success rate of 75%. None of Luke’s results were deemed outliers to be excluded. These results indicate a growth score of 24.9%, demonstrating some improvement over the course of six weeks. Upon analysis of reading speed, there was a significant improvement of 42% for Luke from the pre-test to the post-test. His average reading speed for the pre-test was 205.1 words per minute compared to 291.2 words per minute for the post-test.

4.5.2 Luke's ELSA_{web} Performance

Luke was able to complete the 10 rounds of the ELSA_{web} program over the course of the six weeks. He had the most success in series A & C, which both target word recognition skills. Even as the program adapted to his capabilities by increasing the level of difficulty, he maintained scores of above 96% and 88% for the duration of the 10 rounds in series A & C, respectively. Luke's strongest progression was shown in series E which focuses on the use of implicit and explicit clues. His progress curve followed the characteristic ebb and flow of what we would expect from the use of ELSA_{web}, however in the latter half of rounds, Luke's overall results increased as a whole as shown in Figure 10. Contrastingly, Luke had the most difficulty in series D & F which focus on grammatical and lexical cues. In both of these series, Luke earned scores of less than 27% and the curve of series D shows no evidence of a steady rise and fall as would be expected. Alternatively, in the curve of series F, after earning his low scores, the curve becomes a steadily increasing rise and fall of scores.

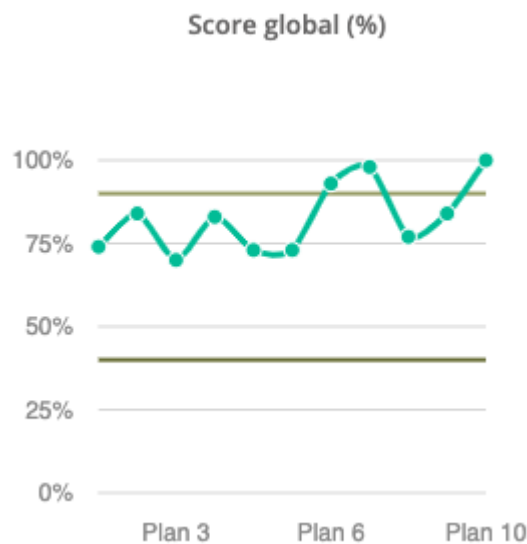


Figure 10. Luke's Overall Score in Series E of the ELSA_{web} Program

Luke’s results in series T also followed an interesting trend in the latter half of rounds. In the first few rounds, Figure 11 shows a consistent increase and decrease between rounds. This pattern breaks down after round 5 and Luke’s results plateau around 50% in the last 3 rounds. Additionally, in looking at the speed results, the curve’s shape resembles the curve of the overall score indicating a potential relationship between the two measures.

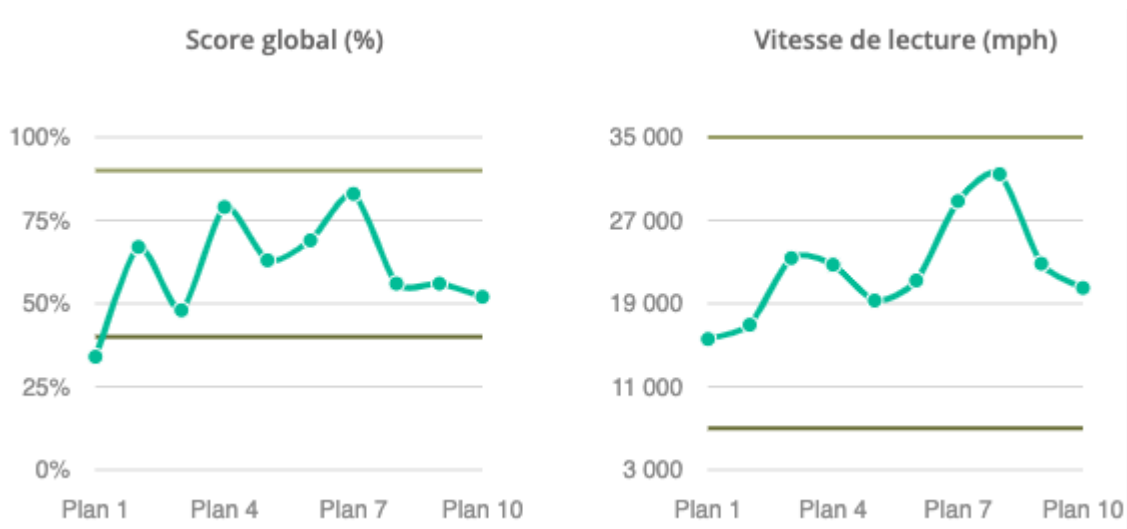


Figure 11. Luke’s Overall Score and Reading Speed in Series T of the ELSA_{web} Program

4.5.3 Luke’s Reflection Questionnaire

Luke generally provided detailed responses in the and was able to identify what he found was easiest and hardest. He almost always provided an answer for what he learned, although sometimes the learning was more about what he liked or did not like as opposed to particular learned skills or habits. The table below highlights his average perceived level of difficulty (1 = very easy & 5 = very hard), whether or not he liked the series, and themes regarding what he found to be easiest and hardest.

Table 5: Luke’s aggregated reflection questionnaire responses

Series	Average Perceived Difficulty	Enjoyed the Series?		Themes
		# of Yes	# of No	
T	3.17	1	5	He felt that the ability to return to the text after answering the first question made it easier. He also found that the true or false questions were easy if you paid attention. He mostly struggled with remembering elements of the text in order to answer the questions. He learned that he didn’t like this series, his memory was poor and that it’s sometimes a good idea to read more slowly.
A	1	6	0	Overall, he felt that all parts of this series were easy and stated that ‘it was honestly fun’. Of the four parts, he did mention that the third part where only the consonants of the target word group appear was the hardest. He learned that you have to really concentrate and that looking at the spacing and form of the words is helpful.
C	1.33	6	0	He usually felt that it was easier when the word group would appear in the middle. He mentioned at one point that he found the long word groups easier because they were easier to distinguish. He found it was harder when the word group would appear to the left or right of the fixation point. He also struggled when word groups appeared that were very similar to the target word group. For this series, he learned more physical responses, such as backing up from the screen when the words were appearing left and right.
D	2.33	5	1	He felt it was made easier that he could change his responses during the 3 exploration phases. He also felt that identifying the title was the easiest part. He struggled with the idea that he couldn’t read the entire text and felt it made it harder to answer the questions. He learned that the timers were stressful, and that identifying the keywords was helpful in identifying themes and descriptions.
F	2.17	4	2	He found it easy to identify concepts after the first reading, like the title and the summary sentence. He found it difficult to come up with all the different keywords. He learned that keywords are essential in fully remembering a text and that he finds it difficult to read a text without all the words.
E	1.83	5	1	He felt that the hints made this series easier and also found the second part, where he could place the words, easier than the first part. He struggled with words that had a lot of synonyms because he found it difficult to determine which particular word the program was looking for. He learned that the hints can be both helpful and unhelpful and he mentioned that this series helped him expand his vocabulary.

4.6 Student 5: Logan

Logan identifies as non-binary and was 13 years and 2 months old at the time of the study. They identified French as their first language, however noted that English is the language in which they are most comfortable, and indicated that they speak both English and French at home. They started learning French at the age of 1 year old and do not speak any additional languages. The last book that Logan had read was a domestic fiction novel which they had finished reading about a few weeks prior. They stated that they do typically choose to read in their free time, and when they do read they prefer reading in English and prefer comedy novels.

4.6.1 Logan's Comprehension Test Performance

In the pre-test, Logan correctly answered three of the six questions giving a 50% success rate. In the post-test, they correctly answered four of six questions giving a success rate of 66.7%. None of Logan's results were deemed outliers to be excluded. These results indicate a growth score of 33.4%, demonstrating some improvement over the course of six weeks. Upon analysis of reading speed, there was some slight deterioration from the pre-test to the post-test. Their average reading speed for the pre-test was 164.7 words per minute compared to 163 words per minute for the post-test.

4.6.2 Logan's ELSA_{web} Performance

Logan was able to complete the 10 rounds of the ELSA_{web} program over the course of the six weeks. They had the most success in series A, which targets word recognition skills, with results above 86% even as the program adapted to their capabilities by increasing the level of difficulty. In the complementary series, series C, they were not as successful, however all their scores were between 77% and 91%. In series E, which focuses on the use of implicit and explicit clues, Logan's results shown in Figure 12 demonstrate a steady rise and fall in overall score as the

difficulty level adapted. Their series F results demonstrated a similar pattern, however with much steeper changes from one round to the next. Series F is similar to series E but focuses on the use of grammatical and lexical cues to create meaning. As for series D, their first round resulted in a low score of 24%, however they made improvements in the following rounds and earned scores above 48% with the curve showing some semblance of rise and fall.

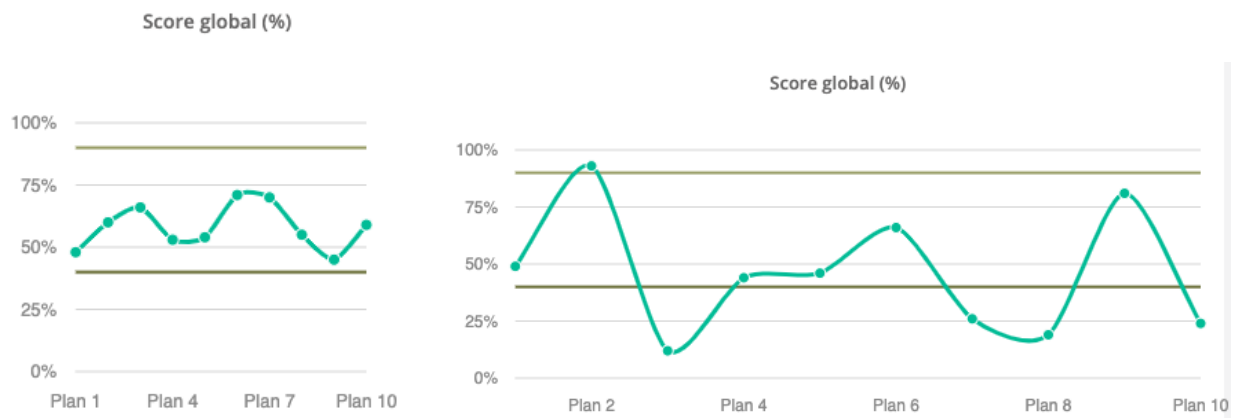


Figure 12. Logan's Overall Scores in Series E (left) and Series F (right) of the ELSA_{web} Program

In Figure 13 we see Logan's series T overall score results which show significant changes between rounds at the beginning but they look to settle into the characteristic ebb and flow of ELSA_{web} results after round 4. The reading speed results are skewed to the left, and with the particularly high reading speed, it is likely that the results of the first round for series T lack accuracy. Looking at the reading speed results beyond round 1, they remain very consistent and their reading speeds range from 7 882 words per hour (131.37 words per minute) to 13 000 words per hour (216.67 words per minute).

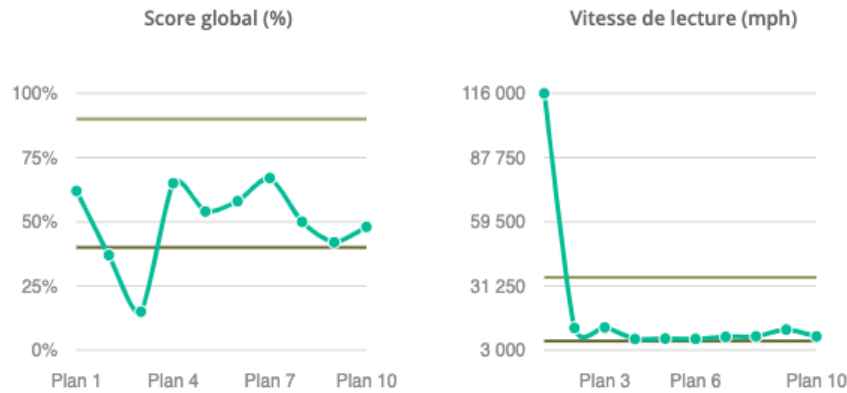


Figure 13. Logan’s Overall Score and Reading Speed in Series T of the ELSA_{web} Program

4.6.3 Logan’s Reflection Questionnaire

Logan did not provide a lot of details in their responses and only sometimes identified specific elements which they found easy or difficult. They often used words like ‘everything’ or ‘nothing’ to describe what was hard and easy. Their answers for what they learned were largely focused on likes and dislikes and personal opinions on the series themselves. They often wrote there was no point in continuing to ask what they learned because they weren’t learning anything. The table below highlights his average perceived level of difficulty (1 = very easy & 5 = very hard), whether or not they liked the series, and themes regarding what they found to be easiest and hardest.

Table 6: Logan’s aggregated reflection questionnaire responses

Series	Average Perceived Difficulty	Enjoyed the Series?		Themes
		# of Yes	# of No	
T	2.5	0	6	Overall, they found that the easiest part was reading the text. They mostly struggled with the questions, specifically the last ones where they had to match book titles to a description and an excerpt. During one week, they learned that they didn’t like answering the book matching activity. The other weeks they either did not answer or said they learned nothing.

A	1.17	2	4	For the part which they found easiest, they said everything but sometimes specifically identified the first round where the word groups appear in the middle. Some weeks they did not find anything hard, while others they found the third part where only the consonants appear was the hardest. They may not have realized it was just the consonants appearing as they said they found it hard when 'there were periods in the word' (the vowels had been replaced by periods). They learned they can sometimes read words quickly, and they don't like when their mistakes are shown at the end because it makes them mad.
C	1.5	2	4	They either stated that they found everything easy or that 'the beginning' (short word groups appearing in the middle) was easiest. Their responses for what they found most difficult do not seem to match with what the series involved. However, one week they did say that 'the end' (long word groups appearing left and right) was the hardest. They learned it was similar to series A and they didn't like that it was not original.
D	3.83	6	0	Overall, they found that the last part where questions were asked and they had to identify the answer in the text was the easiest. He found the fact that it was timed was the hardest part. The only thing they learned is that they liked this series.
F	4.33	5	1	Overall, they found reading the text was the easiest part. They felt the questions were the hardest part. They learned that they preferred series E over series F, but series F was 'still fun'.
E	4.67	6	0	They found that the second part was easiest where they could place the words from the list into the text. They also mentioned that they found simple words like 'le, la, des, ce, qui' were easier to determine. They found determining the missing words the hardest and felt like they were just guessing. They said that they learned nothing and one week they mentioned that this series is 'stupid' because they would need 'mind reading superpowers' to be able to do it.

Chapter Five

Discussion

5.1 Introduction

This study explores both a digital skills-based reading training program and metacognitive reflection and examines whether or not their interaction may have an enhanced impact on reading performance. In order to do this, data was collected from a sample of students from a grade 8 French as a first language school in a minority milieu.

It was found that after using a digital reading training program over the course of six weeks while engaging in weekly metacognitive reflections about their work in the program, all students improved in reading comprehension from the pre to post-test measure. In regards to reading speed, the majority of students showed some level of increase, with varying levels of improvement across the sample. As all students showed some level of improvement in either reading comprehension or reading speed, or both, it can be deduced that all students in the sample experienced gains in overall reading performance after engaging in the digital reading training program and metacognitive reflection.

As reading performance was measured using reading comprehension via question response accuracy and reading speed via words read per minute, it will be important to explore how the different series of the ELSA_{web} program may have contributed to gains in one factor or the other. Additionally, in order to further understand the potential impacts of the metacognitive reflection, students' responses will be cross-referenced with their ELSA_{web} results to identify any possible relationships. Much of this discussion is based on qualitative data and identifies potential avenues for further research.

5.2 Findings of the Study

As reading comprehension has been defined for the purpose of this study as consisting of linguistic comprehension and decoding, both necessary but neither sufficient on its own, we will individually explore the ELSA_{web} series which are tied to those factors for each student. Both series D and F focus primarily on linguistic comprehension, while series A and C focus on decoding. Both Series T and E focus on overall reading performance which includes reading comprehension and reading speed. These series are described in detail in Section 3.3.3 in Table 1. In addition to this, we will discuss the changes that students experienced in reading speed over the course of the study.

5.2.1 John's Reading Performance Outcomes

John's reading comprehension growth was significant at 60%, and although there was some increase in reading speed, this change was negligible. John was very successful in both of the decoding-focused series' and continued to achieve high scores as the program became more difficult. His reflections reveal that he found these series to be pretty easy and overall he enjoyed them, though he did express frustration when the series evolved and the words appeared in random places on the screen as opposed to in the middle. He also states that he began to develop strategies in Series A (though he does not specify what these were) in order to assist him in quickly decoding the words on the screen, which may explain his continued success even as the series became more difficult.

Interestingly, although John was much more successful in series F than D, he rated them very similarly in terms of difficulty, however, on average he did feel that F was slightly easier. This may be indicative that John's self-evaluation may be skewed when it comes to his level of linguistic comprehension. Research has shown "that learners whose skills or knowledge bases are

weak in a particular area tend to overestimate their ability in that area” (Anderson, 2002, p. 5). This suggests that his skills in this area (those required for series D, such as verbal reasoning and knowledge of language structures) are not sufficient enough to be able to accurately self-evaluate (Anderson, 2002). Additionally, the reason for John’s limited success in series D as he progressed through the rounds may be due to his seemingly skewed self-evaluation. When training feels easy, it means that the skills required to perform that training have become fairly automatic (Zimmerman, 2000). The brain can then direct its attention to building on these existing skills (Zimmerman, 2000). In John’s case, in thinking that a series that he did not have significant success in was easy, it is telling his brain to move forward and learn new skills rather than to continue working on the foundational skills he has not mastered yet. He did note, however, that he developed a strategy to help him with series D where he focused on the keywords, which shows that he was aware he was having difficulty and made a change to attempt to overcome this difficulty.

John began with a foundation of strong decoding skills, and throughout the use of ELSA_{web} he developed strategies to help him with the decoding tasks, and made improvements in some areas of linguistic comprehension. His gains in overall reading comprehension are therefore expected. With regards to reading speed, both series T and E included this measure as they focused on reading performance as a whole. In series E, he did make significant improvements in the first few rounds, while in series T after some initial improvement he remained pretty steady. In series T in particular, his reading speed did slow slightly at the end, alongside a steep decrease in reading comprehension. This might suggest that the text became too difficult and even reading at a slower speed would not allow him to adequately comprehend the text. His reflections show that he found both series T and E more difficult than the others, particularly series E which he consistently rated

a 5, very difficult. We can imply from his reflections that he felt a lack of control in this series as he had to do a lot of guessing. The difficulty and lack of enjoyment he experienced in these series could partially explain the limited reading speed improvements as it may have led to a decrease in engagement and, in turn, less reading performance benefits.

In terms of seeing further results, John may have had more success had he maximized the prompted self-reflection tool. He was consistently able to identify what was hard and what was easy, however, he very rarely reflected on what he learned from the series when prompted. This suggests that John may have engaged further had he been provided with a generic prompt where he could just write his thoughts about the series, as opposed to specific questions (Davis, 2003). He did mention a couple strategies when he discussed harder elements at the beginning of the study, however, he did not reflect on any learning throughout the course of the study. Had he done so, it is possible he would have moved from week to week thinking about what he could learn or work on while engaging in the training.

5.2.2 Timothy's Reading Performance Outcomes

Timothy showed improvements in reading comprehension with a growth score of 20%, and even more significant improvements of 40% in reading speed. Timothy was very successful in both of the decoding-focused series' and continued to achieve high scores as the program became more difficult. From his reflections we see that he felt these series to be fairly easy and that he consistently enjoyed them. He did recognize that series A became more difficult as it progressed through its phases and mentioned having more difficulty with the later phases. He was able to develop a strategy to help him mitigate the challenges that these later phases presented. Instead of actually reading the word that would appear, he would quickly look at the shape of the word to see if it matched his mental image of the target word. His continued success in these series

imply that Timothy has strong foundational decoding skills and he was able to identify successful strategies to assist him in novel and more challenging decoding situations.

In both series D and F, Timothy's results suggest that he was very challenged when the program adapted to become more difficult. On average, he rated both series as somewhat difficult and in general he did not really enjoy these series. He also did not mention any strategies that he used to overcome his difficulties, which may explain his steep declines in scores as the program would become more difficult. Klingner et al. (2011) found that "proficient readers use specific metacognitive strategies before, during, and after reading to assist their comprehension of text" (p. 221). Timothy was able to recognize that identifying keywords was consistently the most difficult part for him, which indicates that he was self-monitoring, but he may have only done this when prompted as opposed to during the task. As he does not indicate that he took that information and tried cognitive strategies to circumvent this obstacle, it may mean that he was not aware of strategies that he could implement to help him. Some students do require more explicit assistance from the teacher when it comes to implementing new strategies (Anderson, 2002; Klingner et al., 2011).

As mentioned, Timothy appears to have started this study with strong foundational decoding skills and he was also able to identify strategies to help him further his skills in challenging situations. He struggled a lot more with linguistic comprehension and also may not have applied strategies to assist him with the more challenging texts. This may explain why his growth score in reading comprehension was minimal. As for reading speed, he made significant gains, particularly in series T as his speed improved by almost 300%. It is particularly interesting that in both series T and E, his speed and comprehension curves share many commonalities. In many instances, we see either an increase or decrease simultaneously in the speed and

comprehension curve. This would imply that when he is reading an easier text he is able to do so at a faster speed while he realizes he needs to slow down when faced with something more challenging. His reflections indicate that he found these two series the most difficult and rarely enjoyed them. In fact, the only time he enjoyed these series was during the first week which implies that once the program adapted to become more difficult, he stopped enjoying it, which could have had some impact on his overall outcomes.

Timothy may have seen further results if he had been able to be more consistent in his reflection responses and engaged further in what he learned. He occasionally mentioned things he learned from the content of the texts used in the program which suggests that this particular reflection question may have needed a more clear explanation on expectations. Had Timothy been asked about what strategies he was using as opposed to what he learned, he may have been prompted to try new strategies in the series which he found more difficult.

5.2.3 Melissa's Reading Performance Outcomes

Of the sample, Melissa was the only student who was unable to complete the program over the course of the six-week study period. She fully completed three rounds and had begun the fourth round out of ten. Based on knowledge of this student's reading struggles prior to beginning this study, this result was unsurprising. This student presented decoding difficulties in the classroom, which often led to frustration and disengagement. It is reasonable to suggest that this reading training study was quite difficult for her and likely led to disengagement, which would explain the low completion rate. Although she was unable to complete much of the program in this timeframe, she still showed significant improvement. She obtained a growth score of 125% in reading comprehension and improved in reading speed by 117%.

Melissa earned her highest scores in the decoding series', A and C. It is difficult to determine how she handled the adaptability of the program as she only completed three rounds. That said, over the course of the three rounds which would have adapted slightly from round-to-round, she remained consistent in series C and made small improvements in series A. Her reflections indicate that she found these two series the easiest and she enjoyed them every time. This is a very interesting result as she struggled with decoding in the classroom, which was evident in read-aloud situations. She felt that over time, she was able to recognize words more quickly. This is validated by her series A results which show that words began to appear more quickly by the third round, in response to her success in the first two rounds.

In series D and F, Melissa obtained opposite results. She started with a low result in series D but improved by round three while starting with a mediocre result in series F and obtaining a low result by round three. She consistently rated series F as very difficult and did not enjoy it, while she rated series D as slightly less difficult and did enjoy it. Based on her reflection responses, Melissa was quite frustrated and disengaged when it came to series F. She consistently mentioned that everything about it was difficult and that she learned nothing from the series. This is quite different from her reflection responses for other series which were consistently detailed and highlighted her learnings. Even as the program adapted, it seems as though it remained too difficult for Melissa to fully engage and benefit from this series. Reflecting on observations of Melissa in the classroom, she was consistently capable of summarizing texts aloud when the texts were read by others. This suggests that Melissa is capable of linguistic comprehension, however, if she has to decode text, which she seemingly struggles with, she has difficulty accessing comprehension. Though Melissa did perform better in series A and C with the focus in decoding, it is important to remember that the program was adapting to her level and she was underperforming her peers,

whose results indicate that the program had likely adapted to a higher level. Melissa is a great example of how challenging it can be to distinguish between a poor decoder and a general poor reader (Kleinsz et al., 2017). Strictly based on her results in the ELSA_{web} program, one might assume she is a general poor reader. However, when considering her oral comprehension abilities in the classroom, it is more likely she is a poor decoder. In contrast to her struggles with series F, Melissa indicates that in series D she learned how to understand a text without reading it in its entirety, which is a core element of the linguistic comprehension strand of Scarborough's Reading Rope (Scarborough et al., 2001). This is an encouraging result as she identifies having learned a skill which has been shown to improve reading comprehension and her reading comprehension growth score was indeed significant.

Melissa's results for series T and E, which measure overall reading performance, also support the suggestion that she could be considered a poor decoder. These two series focus on decoding, language comprehension and reading speed simultaneously. She obtained fairly low comprehension scores on the final rounds she completed. Again, this is likely due to her being unable to access comprehension with having to decode the text on her own. Series T also shows that she increased her reading speed by round 4, however, this was coupled with a very low comprehension score of 15%. This could indicate that she stopped using her cognitive resources to try to decode in order to get through it and, as a result, demonstrated very little comprehension. Melissa ranked series T and E as the most difficult of the six. She consistently enjoyed series E but consistently did not enjoy series T. She repeatedly mentions in her reflections that she struggled to 'pay attention to the texts'. This may also be indicative of her disengagement in these series. In the classroom, it was common to observe Melissa staring off into space when she perceived something as being too difficult, particularly when it involved reading and/or writing.

Based on Melissa's significant improvements in both reading comprehension and reading speed, it appears that the ELSA_{web} program combined with the metacognitive reflection was beneficial. The reflection element of this study may have played a crucial role for Melissa as Jonker et al. (2012) state that "reflection is considered a key factor in expert learning and refers to the extent to which individuals are able to appraise what they have learned and to integrate these experiences into future actions, thereby maximizing performance improvements" (p. 224). Melissa engaged very well in her reflection responses and was able to identify what she was learning and her results suggest that she was able to integrate her learning into future sessions as well. It would be interesting to see her engage in a similar study in English. She mentioned that she prefers to read in English and from observation as her teacher, she generally chose to engage in conversation with her peers in English as well. It is possible that French vocabulary was a barrier for Melissa and she might be able to engage further in the language comprehension series' if they were in English.

5.2.4 Luke's Reading Performance Outcomes

Luke is a very strong reader and he consistently reads books above his grade level. Even with this strong foundation, he still saw improvements after engaging in this study. Luke had a reading comprehension growth score of about 25% with an increase in reading speed by 42%. Luke was very successful in both of the decoding-focused series' and continued to achieve very high scores even as the program became more difficult. He enjoyed these series and consistently ranked these as very easy, feeling that series C was slightly more difficult than series A, which is validated by the slightly lower results in series C compared to his results in series A. In his reflection responses, he identifies strategies that he learned for improving his skills in both of these series. Like Timothy, he began to look at the shape of the word instead of reading the word to see

if it matched his mental image of the target word. In addition to that, as the series evolved, he developed a more physical strategy of moving back from the computer screen to widen his view when words would appear on the left and right sides of the page. As he was able to identify and use these strategies, it follows that he was able to maintain his consistently high scores while the program became more difficult.

Luke obtained his overall lowest scores in both series D and F, 19% and 26% respectively. He was able to come back from these low scores quickly, which suggests that the program may have just become too difficult for his reading level in those particular rounds which occurred in the middle of the training (rounds 4, 5, and 7 out of 10). He had a hard time trying to read the texts which had words removed, but discovered quickly that this meant he needed to use a strategy to be able to have success in these series. Once he figured out the importance of identifying keywords, he seemed to have more success, particularly in series F. His overall scores in series D were much lower than in series F, but his difficulty rankings of the two were quite similar, both of which sat between easy and neutral. Based on his results, in particular for series D, I would have expected a ranking which indicated some difficulty. It is possible that, as was suggested for John, Luke's self-evaluation may also be skewed when it comes to his level of linguistic comprehension. However, based on observation as the teacher, Luke may not have wanted to admit that he found these series difficult as he set very high standards for himself as a student.

Luke went into this study as a very strong reader and it is evident that he is particularly strong in decoding. The fact that he was able to identify strategies to help him improve in all of the series also confirms that he is a proficient reader (Klingner et al., 2011). In both series T and E, Luke's overall score curve mostly behaved as we would expect from the use of the ELSA_{web} program, showing increases and decreases in scores but progressively improving over the course

of the ten rounds. However, he did struggle at the end of series T which also corresponded with a decrease in reading speed. This suggests that the texts became more difficult for Luke and he adapted as best he could by slowing down his reading speed. In fact, he mentions as part of his reflection in series T that he learned that sometimes it is necessary to slow down when reading. Additionally, this comment was made during the last week, simultaneous to the drop in overall scores and speed. He found series T most difficult and didn't enjoy it while mostly enjoying series E and finding it fairly easy. He made significant gains in reading speed while also maintaining strong comprehension scores. He also noted that this series allowed him to expand his vocabulary which shows he understood one of the benefits of engaging in this activity and how it could help him in future reading.

Of the sample, Luke demonstrated the best engagement in the metacognitive reflection portion of this study. This is reasonable as he was also the strongest reader of the sample to begin with. As was mentioned, proficient readers are able to engage in metacognitive activities while reading, which enhances their overall reading performance (Klingner et al., 2011). It is likely that Luke is able to utilize reading strategies without being prompted as he was quickly able to make corrections throughout the course of this study. It is encouraging that even as a strong reader, Luke saw improvements in reading comprehension and reading speed after engaging in this study.

5.2.5 Logan's Reading Performance Outcomes

Logan showed improvements in reading comprehension with a growth score of about 33%, however, there was a slight deterioration in reading speed (~ 1%). Logan did very well in series A, and also had success in series C. They did experience some declines during some rounds but were able to bring their score back up in the round immediately after. Their reflections indicate that they found these series' to be fairly easy but generally, they did not really enjoy them.

Additionally, their reflections indicate perhaps a misunderstanding in what was occurring for part of series A which may have led to some of the lack of enjoyment, as well as not fully benefiting from the series. When the series evolved and the vowels were removed and replaced by dots, Logan thought that these were periods and did not understand why they were there in the middle of the words. There was not much reflection on what was learned, however, they did recognize that series A and C were quite similar in nature.

In series F, they obtained some very low scores, the lowest being 12%, while in series D they obtained decent scores after the first round at 24%. In both of these series they experienced some large changes in scores (increasing to decreasing) from round to round. They found these series to be fairly difficult however they did enjoy them. They found series F to be slightly harder, which is validated by a number of very low scores obtained in series F. There was not much detailed reflection done for these series.

As for series T and E, they had some difficulty at times, but overall maintained decent scores and increased and decreased as expected. They felt that series E was quite difficult while series T was somewhat easy, which is an interesting response when considering their results. The curves for these two series are actually quite similar despite one outlier for series T, implying that the two series presented a similar level of challenge for Logan. This may suggest some issues with self-evaluation. They were able to recognize in series E that identifying words like determiners was a lot easier than identifying nouns, which demonstrates they began to use a language structures strategy (Scarborough et al., 2001). Similar to John, we can imply from their reflections that they felt a lack of control in this series as they had to do a lot of guessing. The difficulty they experienced in series E could partially explain the limited reading speed improvements as they may not have taken the time to read if they felt as though they were just guessing anyway.

In general, Logan did not engage effectively in the metacognitive reflection portion of this study. They made many comments in regards to their preferences and shared their feelings towards certain series, such as indicating that series E was ‘stupid’. Logan may have needed more clear instruction on how to engage in the reflection in order to fully benefit from this portion of the study. It should be noted that Logan was 13 years and 2 months old at the time of the study, about a year younger than the rest of the students of the sample, and by birth year they should be in grade 7 as opposed to grade 8. It is around the age of 12 years old when children are beginning to have the capacity to “use reflection to optimize the learning process” (Jonker et al., 2012, p. 227). Considering this, it is possible that Logan had not developed their reflection skills to the same degree as their slightly older peers. Additionally, some skewed results suggest that the study itself may not have been done effectively by Logan either. For example, some of the reading speeds that are measured are impossible, suggesting that they clicked that they had finished reading the text the second that it appeared on the screen. Had Logan been able to engage more effectively in both the ELSA_{web} program and the metacognitive reflection, they may have seen gains in reading speed and even further gains in reading comprehension.

5.3 Conclusion

In terms of collective results, all students in the sample had higher scores and enjoyment levels in the series’ relating to decoding, A and C. This implies that as a whole, students felt more comfortable and were more skilled at the decoding tasks. However, it is important to note, that although series D and F focused on linguistic comprehension, they still required students to decode as they involved reading printed text. There are a couple reasons as to why students may have had more difficulty with series D and F compared to A and C. First, their linguistic comprehension skills may not yet be as well developed as their decoding skills. Another possibility is that some

students may have struggled with some language barriers. Although this study was conducted in a French as a first language school, the majority of students disclosed that English was their perceived first language and that which they were most comfortable with. As a result of this, students may have struggled with comprehension of the French vocabulary as opposed to struggling with the comprehension of printed text in general. With regards to series T and E, these were generally perceived to be fairly difficult, which is understandable given that these two series bring everything together: decoding, linguistic comprehension, and reading speed.

The level of engagement with the metacognitive reflection varied greatly across students. The two students who engaged most thoroughly with the metacognitive reflection, Melissa and Luke, also saw the greatest gains in both reading comprehension and reading speed. Even with minimal engagement, the other three students were still able to see gains in either reading comprehension, reading speed, or both.

Chapter Six

Conclusion, Limitations, and Recommendations

6.1 Conclusion

This study investigates the potential interactions between a digital reading training program and metacognitive reflection, and how they might relate to improved reading performance. The digital reading training program used for the purpose of this study was ELSA_{web}, while Google Forms was used to facilitate the metacognitive reflection questionnaires. Reading performance changes were measured using pre- and post-test growth scores.

The findings of this study indicate that the use of a digital reading training program coupled with weekly metacognitive reflections was positively correlated with improved reading performance, measured by both speed and comprehension. In fact, the use of these tools led to improved reading comprehension for all students in the sample. As these tools were used together over the course of this study, it is unclear whether the use of these tools individually would have led to similar results.

As a classroom teacher, this study provided significant insights into how we can better support students on their reading journey. First, using class time to focus specifically on the component skills of reading is beneficial as it can lead to gains in reading performance for all students, whether they are struggling readers or not. It is essential, however, to have access to a program such as ELSA which is able to adapt in real-time to meet the needs of each student as a single teacher is unable to do so as effectively and as quickly as these digital tools.

After reading the students' reflection responses which were completed with varying levels of detail, it may be beneficial to spend some time on explicit instruction for metacognitive reflection. This would ensure that students have a full understanding on what it means to reflect at

a metacognitive level and would also be an opportunity to offer them strategies for this higher-order concept of “thinking about thinking” (Klingner et al., 2011, p. 220). Additionally, the use of generic prompts may lead to more unexpected and interesting insights from the students on their learning as they can share their exact thoughts without being directed.

This study also suggests that reading training intervention can be successful beyond the early years of learning to read. As mentioned throughout these chapters, there is a significant amount of children who are not reading at their expected level. The results from this study are encouraging as they indicate that even at a later age, we are able to implement interventions which allow for reading performance improvement and consequently allow students to reach and exceed an adequate reading level.

6.2 Limitations of the Study

As is expected, there are limitations to this study, notably the limited number of participants. This study was conducted in a class of nine students, five of which were included as part of the sample, which is a very small representation of grade 8 French readers. As discussed in the data analysis, in addition to this small sample size, the number of assessment questions used for the pre- and post- test was small as well, with only 6 items per assessment. What furthered this limitation was the need to eliminate outliers. This may have led to more significant growth scores from pre- to post-test. Additionally, this study was conducted in a classroom setting due to its case study nature. As a classroom is an ever-adapting and somewhat unpredictable environment, each student may not have spent the same amount of time using the ELSA program and their session time may have been interrupted. Examples of this could include taking a bathroom break or evacuating the school for a fire drill. Finally, some students may not have followed the instructions of the program but rather focused on simply getting it completed. As the sessions were student-

directed with very little teacher intervention and no resulting grade, students may not have been as determined to do it correctly relative to other assigned tasks.

6.3 Recommendations for Future Studies

The findings of this study point to a number of possible avenues for future research in digital reading training programs and metacognitive reflection. First, a longitudinal study which allows students to set goals before beginning the reading training program, on which they can then reflect on over a longer period of time. This may further direct their reflections and entice students to identify strategies that will allow them to achieve their goal. Second, a study which allows students access to the reading training program at any time, both in and outside of school. This study would still include the element of metacognitive reflection on a predetermined basis. It would be interesting to see if those students who spend more time using the program are able and more willing to engage further in their reflections. Finally, a study which incorporates oral reflection and discussion as opposed to a written questionnaire. This would allow the researcher to prompt deeper reflection from the student by asking specific questions as well as assist the student in developing strategies that the student can use in future encounters with the program.

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Appendix A

Initial Recruitment Letter for Parents/Guardians of Students

Ashley Diamond
Graduate Student, Faculty of Education
Memorial University
St. John's, NL
A1B 3X9
Email: adiamond@csfptnl.ca

Dear Parent or Guardian,

My name is Ashley Diamond, one of your child's teachers, and I am also a graduate student in the Master of Education program at Memorial University. I am enrolled in the thesis stream of the Curriculum, Teaching and Learning Studies route with a concentration in second language education, particularly French as a second language. As the basis of my thesis, I am carrying out a research study which looks at the impacts of metacognitive reflection coupled with a digital skills-based reading training program.

In the coming 6 weeks, your child will spend 18 30-minute sessions (3 sessions a week) completing the digital skills training program tasks in the classroom. At the end of each week, your child will complete a 20-minute metacognitive reflection session where they are prompted to reflect on their training. Prior to the training, a 30-minute non-evaluated pre-test will be administered to assess your child's initial reading level and it will be once again administered after the training. As the development of reading skills falls directly within the curriculum of Français langue première 8, all students will complete these training and reflection sessions and they will take place during the regularly scheduled periods for this course.

After the six weeks of reading training has occurred in class, participation in this study would mean granting the permission for your child's training data to be used. Please note that participation is not required by the school or teacher, and choosing not to participate will have no implications on your child's school evaluation or progress.

Another letter as well as a consent form will be sent home once the training is complete where you may indicate whether you wish to have your child's data used in the study.

I sincerely appreciate your time and help in this matter. You and your child's involvement in this research project will help build a strong bridge between the community of Newfoundland and

Labrador and the work performed at Memorial. It will also help to develop tools to enable teachers and students to enhance students' reading performance.

Please feel free to get in touch with me via email (adiamond@csfptnl.ca) if you have any questions or concerns pertaining to this study.

Sincerely,

Ashley Diamond
Teacher & Graduate Student

The proposal for this research has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709-864-2861.

Appendix B

Second Recruitment Letter for Parents/Guardians of Students

Ashley Diamond
Graduate Student, Faculty of Education
Memorial University
St. John's, NL
A1B 3X9
Email: adiamond@csfptnl.ca

Dear Parent or Guardian,

My name is Ashley Diamond, one of your child's teachers, and I am also a graduate student in the Master of Education program at Memorial University. I am enrolled in the thesis stream of the Curriculum, Teaching and Learning Studies route with a concentration in second language education, particularly French as a second language. As the basis of my thesis, I am carrying out a research study which looks at the impacts of metacognitive reflection coupled with a digital skills-based reading training program.

Over the course of 6 weeks, your child has spent 18 30-minute sessions (3 sessions a week) completing the digital skills training program tasks in the classroom. At the end of each week, your child completed a 20-minute metacognitive reflection session where they were prompted to reflect on their training. Prior to the training, a 30-minute non-evaluated pre-test was administered to assess your child's initial reading level and it was once again administered after the training. As the development of reading skills falls directly within the curriculum of *Français langue première 8*, all students completed these training and reflection sessions and they took place during the regularly scheduled periods for this course. Participation in this study would mean granting the permission for your child's training data to be used. Please note that participation is not required by the school or teacher, and choosing not to participate will have no implications on your child's school evaluation or progress.

With this in mind, I invite you to read the enclosed Informed Consent Form, which presents the study in more detail as well as you and your child's rights as potential participants.

Should you wish to have your child's data used in the study, please fill out, sign and return the last page of this letter: Consent (copy for researcher). An envelope is provided. Should you not authorize your child to participate in the study, please return the blank consent form.

I sincerely appreciate your time and help in this matter. You and your child's involvement in this research project will help build a strong bridge between the community of Newfoundland and Labrador and the work performed at Memorial. It will also help to develop tools to enable teachers and students to enhance students' reading performance.

Please feel free to get in touch with me via email (adiamond@csfptnl.ca) if you have any questions or concerns pertaining to this study.

Sincerely,

Ashley Diamond
Teacher & Graduate Student

The proposal for this research has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709-864-2861.

Appendix C

Informed Consent Form

Title: Metacognitive Reflection and Digital Skills-Based Reading Training in French Minority Language Schools

Researcher: Ashley Diamond, Graduate Student, Faculty of Education, Memorial University of Newfoundland, St. John's, NL, A1B 3X9, Email: adiamond@csfptnl.ca

Dear Parent or Guardian,

You and your child are invited to take part in a research project entitled Metacognitive Reflection and Digital Skills-Based Reading Training in French Minority Language Schools.

This form is part of the process of informed consent. It should give you the basic idea of what the research is about and what you and your child's participation will involve. It also describes your right to withdraw from the study. In order to decide whether you wish to authorize your child's participation in this research study, you should understand enough about its risks and benefits to be able to make an informed decision. This is the informed consent process. Take the time to read this carefully and to understand the information given to you. Please contact the teacher-researcher, Ashley Diamond, if you have any questions about the study or for more information not included here before you consent.

It is entirely up to you to decide whether to have your child's data used in this research. If you choose not to authorize the use of your child's data in this research, there will be no negative consequences for you or your child, now or in the future.

Introduction

We are conducting a collaborative action-research study which looks at the relationship between metacognitive reflection and skills-based reading training in the French language.

Our research team is based at Memorial University of Newfoundland and is led by Ashley Diamond (Principal Researcher), who is a graduate student in the Faculty of Education, under the supervision of Dr. Leslie Redmond, a professor in the Faculty of Education.

As a teacher-researcher, Ashley Diamond will be conducting the study within her *Français langue première 8* course and permission to use the data of students in this course is being requested.

Purpose of study

The goal of this study is to better understand how the act of metacognitive reflection is related to training in a reading skills program in French for language learners in French first language programs. The results of our study will deepen our understanding of the effects of metacognitive

reflection in acquiring reading skills and how it could be applied in acquiring other skills learned in the classroom.

Summary

Below is a summary of the main points concerning your child's participation in the project. More details about each point are presented further on in this letter.

- Students have completed a series of reading skill exercises in French within the digital program. These exercises were designed for all levels of French readers and adapt to the individual reader's skill level as they progress. They vary in format and should be linguistically stimulating and pleasurable for the user. More specific details about the exercises are presented in the next section.
- The exercises were administered to all students in the class at once, supported by the teacher-researcher who was occasionally accompanied by a French-speaking researcher who is supervising the study and is a professor in the Faculty of Education.
- The training took place at the child's school. 18 30-minute sessions were held over the course of six weeks and all students in the class completed the training when present.
- On a weekly basis, a 20-minute metacognitive reflection session was held where the students were prompted to reflect on their training.
- Prior to the training, a 30-minute non-evaluated pre-test was administered to assess each students' initial reading level and it was once again administered after the training.
- The training took place in the classroom during instructional time using a school-provided Chromebook.
- Participation entails granting permission for your child's training data to be used and it is on a voluntary basis. Should you not authorize your child's participation, there will be no implications on your child's school evaluation or progress.
- The risks run by participants in this project are minimal, being very similar to those run by children in the course of an average school day.
- All information collected will remain confidential; participants will never be named in any project publication or presentation.

What you will do in this study

Students have spent about 9 hours over the course of 6 weeks working on the ELSA_{web} (<http://www.elsa-afl.com/>) reading training program. These exercises were done in the classroom at pre-selected times and all students completed the training and reflection at the same time. The reflection was in the style of a questionnaire that required students to answer both closed and open questions. Additionally, a pre-test and a post-test was implemented at the beginning and end,

respectively, of the training program. More information is provided in the *Length of Time* section which explains how the program aligns with curriculum objectives.

ELSA_{web} is grounded in research conducted at the *Institut National de la Recherche Pédagogique* and was developed in France by the *Association Française pour la Lecture*. Previous studies on ELSA_{web} have shown that students training with this program see significant gains in their reading performance (comprehension and speed).

ELSA_{web} helps learners develop different component skills that play a part in the activity of reading, using six sets or “Series” of exercises (Series T, A, D, C, E, & F). Two of these series, (Series A and Series C), deal with units smaller than a sentence. One series, (Series E), proposes exercises to work on sentence-level performance. And three series, (Series D, F and T), focus on reading short texts. Each of these Series proposes evidence-based activities that foster reading performance improvement. The online format allows learners to access the program at their leisure and advance at their own pace, as the program adapts to each learner’s abilities. Each of the series is described below:

Series T: Series T serves as a measure of reading speed and comprehension. After reading a text, students answer 8 comprehension questions.

Series A and C: In these two series, students will work with words and segments in order to improve their automatic recognition as well as the accuracy of the information discerned.

Series D and Series F: The exercises in Series D and Series F help students to progressively organize their mental representation of a text through selective information searches using both lexical and grammatical clues.

Series E: In this series, students will engage in a task where they have to fill in the blanks with missing words in a text. They can avail of individualized and explicit clues to help them complete the task.

Length of time

18 30-minute sessions were held over 6 weeks. This training aligns with the curriculum outcomes for the *Français langue première 8* course and thus it was reasonable to be completing this project during class time. In particular, this training focuses on 4 of the general learning outcomes: L2, L3, L4 & L5, which are explained in detail in the course curriculum guide linked below.

https://www.gov.nl.ca/education/files/Francais_7e-9e_annee_Programme_detudes_2002-2008.pdf

Withdrawal from the study

Your child's participation in this research, meaning permission to use their training data, is voluntary. Children can be clear about what they want and do not want. Please ask them what their wishes are. If they do not wish to take part, we will respect their wishes. This will not lead to any negative consequences.

The authorization of use of your child's data in this research is voluntary. You are free to withdraw their data from the project until the data are aggregated (June 15, 2022). If you wish to have your child's data withdrawn, contact the teacher-researcher before June 15, 2022. This withdrawal will not lead to any negative consequences.

Possible benefits

The ELSA reading skills training program that was used has been shown through previous research to be a very effective resource for reading training for users between the ages of 9 and 18.

Furthermore, this study will contribute to the knowledge base concerning reading in French and the interaction of metacognitive reflection with reading skills training. In identifying the effects of the metacognitive reflection element of this study, we hope to be able to formulate recommendations to better support learners in the development of a variety of skills.

Possible risks

Participation in this study is not associated with any significant risk.

Confidentiality vs. Anonymity

There is a difference between confidentiality and anonymity: Confidentiality is ensuring that identities of participants are accessible only to those authorized to have access. Anonymity is a result of not disclosing participant's identifying characteristics (such as name or description of physical appearance).

Confidentiality and Storage of Data

All of the written data that we obtain from your child during the research will be kept confidential. The data will be stored in a password-protected spreadsheet format on a password-protected computer and no data allowing your child to be identified will be kept. Each participant will be identified with an alphanumeric code. The results will be numerically coded in order to facilitate statistical analysis. The data will be retained for a minimum of five years as required by Memorial University policy on Integrity in Scholarly Research.

Anonymity

An envelope has been provided for your child to return the signed form should you and they wish to participate and your child may hand it to the teacher-researcher, Ashley Diamond, privately as they feel comfortable. Should you and they not wish to participate, your child can return the

unsigned consent form to Ashley Diamond in the same manner as previously stated. Additionally, you may choose to return a scanned version of the signed form via email at adiamond@csfptnl.ca. The data will be recorded in a way which does not allow for participants to be identified. Each participant will be identified by an alphanumeric code and the only personal information kept on file will be their gender, their age at the time of participation and the language that they speak at home. Note that due to the nature of the teacher-student relationship, the data will be identifiable to the teacher-researcher, Ashley Diamond.

Reporting of Results

The present research proposal focuses on group results, which will be presented using descriptive and inferential statistics as well as qualitative data analysis. The data collected from this project will be published in a variety of forms (journal articles, conference presentation, reports to educators and teacher workshops). The published Master's thesis will also be available through Memorial's QEII Library.

Sharing of Results with Participants

The knowledge gained in this project will be disseminated to teachers in various forms. A summary of the major results and their interpretation will be sent to the participating school. Families will receive a summary of the major findings in the form of a written report.

Questions

You are welcome to ask questions at any time during your participation in this research. If you would like more information about this study, please contact Ashley Diamond (adiamond@csfptnl.ca) or Leslie Redmond (leslie.redmond@mun.ca).

The proposal for this research has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709-864-2861.

Consent (copy for parent/guardian)

Your signature on this form means that:

- You have read the information about the research.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are not required to participate, and that doing so will not affect you now or in the future.

If you sign this form, you do not give up your legal rights and do not release the researchers from their professional responsibilities.

Your signature:

I have read and understood what this study is about and appreciate the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered.

- I authorize my child to participate in the research project understanding the risks and contributions of his/her participation, and that that his/her participation is voluntary.
- I authorize my child’s results to be anonymously recorded during the data collection (via the software designed for the study).
- I authorize my child’s data be stored at Memorial University of Newfoundland, with access restricted to authorized persons, as discussed above.

A copy of this Informed Consent Form has been given to me for my records.

Signature of parent/guardian

Date

Signature of participant

Date

Researcher’s Signature

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

Signature of principal investigator

Date

Consent (copy for researcher)

Your signature on this form means that:

- You have read the information about the research.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are not required to participate, and that doing so will not affect you now or in the future.

If you sign this form, you do not give up your legal rights and do not release the researchers from their professional responsibilities.

Your signature:

I have read and understood what this study is about and appreciate the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered.

- I authorize my child to participate in the research project understanding the risks and contributions of his/her participation, and that his/her participation is voluntary.
- I authorize my child’s results to be anonymously recorded during the data collection (via the software designed for the study).
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Date

Signature of participant

Date

Researcher’s Signature

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

Signature of principal investigator

Date

Appendix D

Demographic Questionnaire

<p style="text-align: center;">ÉTUDE DE RÉFLEXION SUR L'ENTRAÎNEMENT DE LECTURE QUESTIONNAIRE DE DONNÉES DÉMOGRAPHIQUE</p>
--

CODE: _____

(Veuillez consulter la feuille ci-jointe pour obtenir des instructions sur la façon de créer votre code.)

1. Sexe (F/M/X) _____

2. Âge _____

Contexte linguistique

3. Quelle est ta langue première? _____

4. Dans quelle langue es-tu le plus à l'aise? _____

5. Quelle langue parles-tu à la maison? _____

6. À quel âge as-tu commencé à apprendre le français? _____

7. Parles-tu d'autres langues?

OUI NON

Si oui, lesquelles?

Contexte de lecture

8. Quel est le dernier livre que tu as lu (papier ou électronique)?

9. Quand as-tu terminé ce livre? _____

10. Choisis-tu souvent de lire pendant ton temps libre ? **OUI** **NON**

11. Quel est ton type de livre préféré? _____

12. Dans quelle langue préfères-tu lire? _____

ÉTUDE DE RÉFLEXION SUR L'ENTRAÎNEMENT DE LECTURE

CRÉER TON CODE PARTICIPANT

Afin de relier tes données démographiques, tes résultats aux tests (pré et post) et tes résultats au programme de formation ELSA, chaque participant sera attribué un code alphanumérique. Cela nous permettra de conserver tes données en toute sécurité, sans qu'aucune information identifiable ne se trouve sur les fiches de données.

Comment créer ton code alphanumérique? Prends les initiales de ton prénom et de ton nom de famille, ainsi que ton jour et ton mois de naissance.

Voilà des exemples:

Nom: Jane Smith
Anniversaire: Le 2 décembre

CODE: JS0212

Nom: Jane Anne Smith
Anniversaire: Le 2 décembre

CODE: JAS0212

Nom: Jane Smith-Brown
Anniversaire: Le 2 décembre

CODE: JSB0212

Il est important de noter ton code et de le conserver pendant toute la durée de l'étude.

Appendix E

Pre-Test Reading Performance Assessment

TEXTE 1 (64 mots)

Un bébé de vingt mois jouait sur la plage. Vers 6 heures du soir, le bébé a été attaqué par un berger allemand de grande taille. Le chien a mordu l'enfant à l'arrière de la tête. En tentant de protéger son fils, la mère a aussi été mordue au bras gauche. Pourtant, la présence des chiens sur les plages est interdite dans cette région.

QUESTION 1 : Le texte parle...

1. d'un homme qui promenait son chien.
2. d'un enfant qui jouait sur une plage.
3. d'un bébé qui a été mordu par un chien.

TEXTE 2 (91 mots)

Une fillette de quatre ans a été retrouvée saine et sauve après avoir sauté du quatrième étage d'un immeuble afin de fuir un incendie. La petite Christelle se trouvait seule en compagnie de son petit frère. Elle a eu peur quand le feu s'est déclaré dans une chambre de l'appartement. Elle a alors sauté par la fenêtre. Heureusement, la petite s'est retrouvée sur la pelouse sans une égratignure, quinze mètres plus bas. L'incendie a rapidement été éteint. Le petit frère de la fillette a été retrouvé lui aussi sain et sauf.

QUESTION 2 : Le texte parle...

1. de la manière dont une fillette a échappé à un incendie.
2. d'une fillette qui a sauté par une fenêtre de son immeuble.
3. d'une fillette qui a été sauvée par des pompiers.

TEXTE 3 (102 mots)

Pierre et André sont partis de Cap Breton à bord d'un hélicoptère et ont atteint l'île d'Anticosti. Ils ont battu, en dix heures de vol, la meilleure performance de traversée maritime. L'hélicoptère des deux pilotes, qui devait se poser sur l'héliport de l'île, est tombé en mer dans la baie des sables. Ils avaient tenté de se poser trois fois, sans succès, sur une petite piste de 14 m de large et 125 m de long. À cause du manque de place, l'équipage a dû à chaque fois interrompre l'atterrissage, puis repartir. Les pilotes ont finalement préféré terminer leur voyage sur l'eau.

QUESTION 3 : Le texte parle...

1. de l'échec d'une tentative de traversée du golfe du Saint-Laurent en bateau à moteur.
2. d'une arrivée mouvementée.
3. d'une traversée maritime record

TEXTE 4 (119 mots)

L'équipage du brise-glace canadien Shediac a aidé une centaine de baleines à regagner la haute mer à la sortie du golfe Saint-Laurent. Comment? En diffusant de la musique classique! Ces baleines, longues de 3 à 4 mètres, ont failli être victimes de leur gourmandise. Elles s'étaient aventurées sur les hauts fonds entre Baie-Comeau et Matane en poursuivant un immense banc de poissons. Par malheur, elles s'étaient retrouvées prisonnières des glaces. Les autorités canadiennes, ne souhaitant pas voir disparaître des baleines, ont décidé de tenter une opération de secours en creusant un canal de 20 kilomètres. Mais comment les attirer? À bord, quelqu'un a eu l'idée de diffuser de la musique par haut-parleurs. Ainsi, les baleines ont pu être sauvées.

QUESTION 4 : Le texte parle...

1. de baleines prisonnières des glaces
2. de chasseurs de baleines dans le golfe du Saint-Laurent
3. d'un sauvetage de baleines facilité par leur goût pour la musique

TEXTE 5 (179 mots)

Les éleveurs d'abeilles de l'Estrie risquent d'avoir une mauvaise surprise quand ils vont ouvrir leurs ruches. Non seulement ils n'y trouveront pas le miel espéré, mais ils y verront des abeilles affamées. Jean Charron, président du syndicat des apiculteurs de l'Estrie, tient à les prévenir. S'ils attendent quelques semaines avant de regarder les cadres, il sera peut-être trop tard : les abeilles seront mortes ou auront quitté la ruche. «Je n'en suis pas revenu moi-même quand j'ai ouvert mes ruches il y a quelques jours. Ça fait trente ans que je fais du miel et je n'ai jamais vu ça !», affirme Jean. L'apiculteur explique ainsi la situation : «Le printemps a été froid, ensuite il a fait très sec. Les fleurs n'ont pas produit autant de nectar que d'habitude. Les abeilles n'ont pas pu faire de provisions ; il va donc falloir les nourrir avec du sirop (1 livre de sucre pour 1 litre d'eau). La récolte s'annonce catastrophique. Au Québec, la production sera inférieure à dix tonnes, contre une centaine habituellement». Heureusement, les deux récoltes précédentes avaient été très bonnes.

QUESTION 5 : Le texte parle...

1. du mode de vie des abeilles
2. du manque de miel en Estrie
3. de l'influence du climat sur la production de miel

TEXTE 6 (190 mots)

En 2004, Claudia Garneau et Charlaïne Dalpé avaient 12 ans. Elles passaient leurs vacances à Grande-Vallée, en Gaspésie. Elles ont inséré un message dans une bouteille de plastique, qu'elles ont lancée à la mer. Surprise! Un garçon de 9 ans vient de retrouver leur bouteille sur une plage d'Irlande. La bouteille a traversé l'Atlantique, parcourant plus de 4 000 km. Quand Vik Millea a découvert le message, il a couru voir sa mère pour qu'elle l'aide à le déchiffrer. Comme il était rédigé en français, ils ont utilisé un outil de traduction sur Internet. Le garçon s'est empressé

d'écrire à cette adresse courriel, mais elle n'était plus en fonction. Par chance, un ami de Charlaïne a lu un avis de recherche publié dans un journal montréalais et il a contacté la jeune fille. Le lendemain, une rencontre sur Internet s'est organisée entre Vik, Claudia et Charlaïne. Et pour terminer en beauté ce « conte de fées », une agence de tourisme a invité les deux jeunes femmes à séjourner en Irlande l'été prochain. Elles en profiteront pour rencontrer Vik et revoir la lettre qui a fait le tour des médias.

QUESTION 6 : Le texte parle...

1. d'un jeune garçon passionné par les contes de fées
2. de l'histoire d'une bouteille lancée à la mer qui a été retrouvée par un jeune Irlandais
3. d'une vieille histoire de bouteille lancée à la mer qui connaît un revirement inattendu

Appendix F

Post-Test Reading Performance Assessment

TEXTE 1 (82 mots)

Le lézard est dans une grande cage. La scène est éclairée d'une pâle lumière rouge. Un serpent est introduit doucement. Les hommes veulent savoir comment le lézard se défend. Dès qu'il aperçoit le serpent, le lézard soulève sa queue et l'agite. Il va même la secouer sous le nez du serpent. Trois fois sur dix, le serpent attrape la queue du lézard. Elle se détache tout de suite et cela permet à son propriétaire de s'enfuir pendant que le serpent la mange.

QUESTION 1 : Le texte parle...

1. du moyen de défense du lézard
2. de l'agressivité du serpent
3. des habitudes alimentaires du lézard

TEXTE 2 (104 mots)

Jack Andraka, 15 ans, s'est intéressé au cancer du pancréas lorsque le frère d'un ami a été emporté par cette maladie. En consultant des articles scientifiques sur Internet, ce jeune Américain a eu l'idée de développer un nouveau test pour déceler la présence de la maladie.

En plus d'être fiable à 90 %, sa technique est huit fois plus rapide et beaucoup moins coûteuse que les tests actuels. Les efforts de Jack ont été récompensés, puisqu'il a remporté 100 000 \$ lors d'un concours scientifique. Le jeune chercheur espère rendre son invention accessible à tous et l'adapter pour diagnostiquer d'autres maladies. Belle carrière en vue, Jack!

QUESTION 2 : Le texte parle...

1. d'un jeune Américain qui a gagné un concours scientifique
2. d'un jeune homme décédé d'un accident de voiture
3. d'un jeune qui a inventé un test de dépistage du cancer

TEXTE 3 (125 mots)

Pour la première fois, un ours brun a été vu en train de se servir d'une pierre pour nettoyer son pelage. Il a été observé pendant une longue minute alors qu'il prenait son bain dans un ruisseau, en Alaska. Un chercheur britannique a eu la chance de voir ce comportement jusqu'alors inconnu chez l'ours.

On savait déjà que l'ours, en proie à des démangeaisons, se gratte le dos contre un arbre ou utilise ses griffes. Mais un nettoyage à la pierre, c'est une découverte! Pourquoi est-ce si surprenant? Car généralement, ce sont les primates (dont le singe et l'homme) qui utilisent des outils pour effectuer leurs tâches quotidiennes. L'ours devient ainsi l'un des rares animaux non primates connus à utiliser un outil pour se laver.

QUESTION 3 : Le texte parle...

1. d'un chercheur en Alaska
2. du mauvais caractère de l'ours brun
3. d'une technique inédite de nettoyage chez l'ours brun

TEXTE 4 (150 mots)

Le médecin Jean-Louis Étienne avait un objectif ambitieux. Il voulait rejoindre le Pôle Nord en tirant un traîneau à pied ou à ski sur 800 kilomètres. Le médecin a commencé sa progression à l'extrême Nord du Canada par des températures atteignant les -46 degrés. Cependant, au cours de son voyage, il est tombé dans une énorme crevasse et s'est blessé à l'épaule. Secouru par un avion, il a finalement été ramené sain et sauf à son camp de base. Jean-Louis Étienne n'est pas un débutant de l'aventure. Il a participé à de multiples expéditions en Amérique du Sud, au Groenland, dans l'Himalaya, et a fait plusieurs traversées de l'Atlantique avec un compagnon. Il s'est spécialisé dans la médecine sportive. Avec son expédition solitaire au pôle nord, il voulait prouver l'intérêt d'une alimentation spéciale qu'il avait mise au point. Une crevasse ne lui aura pas permis de réussir cette première tentative.

QUESTION 4 : Le texte parle...

1. de l'efficacité de la médecine sportive
2. des multiples expéditions réalisées par un médecin
3. de l'échec d'une expédition au Pôle Nord

TEXTE 5 (179 mots)

Les éleveurs d'abeilles de l'Estrie risquent d'avoir une mauvaise surprise quand ils vont ouvrir leurs ruches. Non seulement ils n'y trouveront pas le miel espéré, mais ils y verront des abeilles affamées. Jean Charron, président du syndicat des apiculteurs de l'Estrie, tient à les prévenir. S'ils attendent quelques semaines avant de regarder les cadres, il sera peut-être trop tard : les abeilles seront mortes ou auront quitté la ruche. «Je n'en suis pas revenu moi-même quand j'ai ouvert mes ruches il y a quelques jours. Ça fait trente ans que je fais du miel et je n'ai jamais vu ça !», affirme Jean.

L'apiculteur explique ainsi la situation : «Le printemps a été froid, ensuite il a fait très sec. Les fleurs n'ont pas produit autant de nectar que d'habitude. Les abeilles n'ont pas pu faire de provisions ; il va donc falloir les nourrir avec du sirop (1 livre de sucre pour 1 litre d'eau). La récolte s'annonce catastrophique. Au Québec, la production sera inférieure à dix tonnes, contre une centaine habituellement».

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3. de l'influence du climat sur la production de miel

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QUESTION 6 : Le texte parle...

1. d'un jeune garçon passionné par les contes de fées
2. de l'histoire d'une bouteille lancée à la mer qui a été retrouvée par un jeune Irlandais
3. d'une vieille histoire de bouteille lancée à la mer qui connaît un revirement inattendu

Appendix G

Weekly Metacognitive Reflection Questionnaire

Série T

Après avoir lu un court texte, tu as répondu à 8 questions pour vérifier ta compréhension du texte. Certaines questions étaient du style vrai ou faux tandis que d'autres étaient plus thématiques.

Aimes-tu cette série?

- Oui
- Non

Comment classerais-tu le niveau de difficulté de cette série sur une échelle de 1 à 5 ?
(1 = très facile, 2 = facile, 3 = neutre, 4 = difficile, 5 = très difficile)

- 1
- 2
- 3
- 4
- 5

Quelle partie de cette série as-tu trouvée la plus facile?

Quelle partie de cette série as-tu trouvée la plus difficile?

Qu'as-tu appris de cette série cette semaine?

Série A

Cette série comportait 4 phases au cours desquelles tu as dû cliquer sur la barre d'espacement à chaque fois que tu as vu le groupe de mots pré-identifié . Pour la première phase, les groupes de mots sont affichés au milieu de l'écran. La deuxième phase fonctionne de la même manière mais vous ne voyez que le haut du groupe de mots. Pour la troisième phase, seules les consonnes du groupe de mots apparaissaient à l'écran. Pour la quatrième phase, le groupe de mots pouvait apparaître n'importe où sur la page.

Aimes-tu cette série?

- Oui
- Non

Comment classerais-tu le niveau de difficulté de cette série sur une échelle de 1 à 5 ?
(1 = très facile, 2 = facile, 3 = neutre, 4 = difficile, 5 = très difficile)

- 1
- 2
- 3
- 4
- 5

Quelle partie de cette série as-tu trouvée la plus facile?

Quelle partie de cette série as-tu trouvée la plus difficile?

Qu'as-tu appris de cette série cette semaine?

Série D

Dans la phase d'exploration, un texte était divisé en 4 parties et tu as dû identifier un titre possible, un mot clé et un résumé de phrase pour chaque section du texte. Dans la phase suivante, des questions étaient posées sur les sections du texte et tu as dû identifier dans quelle section et où se trouvait exactement la réponse.

Aimes-tu cette série?

- Oui
- Non

Comment classerais-tu le niveau de difficulté de cette série sur une échelle de 1 à 5 ?
(1 = très facile, 2 = facile, 3 = neutre, 4 = difficile, 5 = très difficile)

- 1
- 2
- 3
- 4
- 5

Quelle partie de cette série as-tu trouvée la plus facile?

Quelle partie de cette série as-tu trouvée la plus difficile?

Qu'as-tu appris de cette série cette semaine?

Série E

Tu as commencé par lire un texte et une fois la première partie de l'activité commencée, certains mots étaient supprimés et tu as dû écrire le mot manquant. Un certain nombre d'outils d'aide étaient à ta disposition. Pour la deuxième partie, une liste de mots t'était fournie et tu as dû les placer aux bons endroits.

Aimes-tu cette série?

- Oui
- Non

Comment classerais-tu le niveau de difficulté de cette série sur une échelle de 1 à 5 ?
(1 = très facile, 2 = facile, 3 = neutre, 4 = difficile, 5 = très difficile)

- 1
- 2
- 3
- 4
- 5

Quelle partie de cette série as-tu trouvée la plus facile?

Quelle partie de cette série as-tu trouvée la plus difficile?

Qu'as-tu appris de cette série cette semaine?

Série C

Cette série comportait 2 phases dans lesquelles on te montrait un groupe de mots avant de commencer. Ensuite, différents groupes de mots clignotaient à l'écran, soit au milieu, soit à gauche ou à droite, et tu as dû choisir oui s'il s'agissait du groupe de mots initial qui t'était montré ou non. Pour la première phase, le groupe de mots identifié était plus court et pour la deuxième phase, le groupe de mots identifié était plus long.

Aimes-tu cette série?

- Oui
- Non

Comment classerais-tu le niveau de difficulté de cette série sur une échelle de 1 à 5 ?
(1 = très facile, 2 = facile, 3 = neutre, 4 = difficile, 5 = très difficile)

- 1
- 2
- 3
- 4
- 5

Quelle partie de cette série as-tu trouvée la plus facile?

Quelle partie de cette série as-tu trouvée la plus difficile?

Qu'as-tu appris de cette série cette semaine?

Série F

Dans la première partie de cette série, tu étais donné un temps limité pour lire un texte court dont seules certaines sections étaient lisibles. Après la lecture, tu as dû identifier un titre possible, un résumé possible, des mots-clés généraux possibles et des mots-clés spécifiques possibles. Ensuite, on te montrait à nouveau le texte avec différentes sections lisibles et tu as dû vérifier tes réponses et apporter les corrections nécessaires après une deuxième lecture. Cette opération se répétait une troisième fois.

Aimes-tu cette série?

- Oui
- Non

Comment classerais-tu le niveau de difficulté de cette série sur une échelle de 1 à 5 ?
(1 = très facile, 2 = facile, 3 = neutre, 4 = difficile, 5 = très difficile)

- 1
- 2
- 3
- 4
- 5

Quelle partie de cette série as-tu trouvée la plus facile?

Quelle partie de cette série as-tu trouvée la plus difficile?

Qu'as-tu appris de cette série cette semaine?
