

**Exploring Secondary Discipline-Specialist Teachers'
Engagement with Discipline-Specific Texts**

by

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Abstract

The purpose of this multiple case study, framed by sociocultural theory, was to explore how secondary discipline specialists engage with discipline-specific texts. When teacher specialists read discipline-specific texts they may not be able to articulate all their metalinguistic awareness. By increasing this awareness, educators increase the tools they have at their disposal for communicating the literacy practices they use to comprehend texts. This research, which took place over several months, involved four discipline-specific specialists—from mathematics, science (biology, physics, or chemistry), English language arts, and social studies—who shared their understandings of how they engaged with discipline-specific texts. Through face-to-face, audio-recorded interviews and think-aloud protocols, the four participants explained and modelled discipline-specific text engagement.

Findings revealed that although the participants were competent discipline-specific text readers, the automaticity of their thinking and their limited awareness of several reading Discourses impeded their ability to verbalize all the literacy practices they employ. Several contributions to scholarship are articulated, emphasizing teachers' need for greater cognizance of discipline-specific literacy practice use and think aloud as a research tool. Contributions to pedagogy include creating a greater awareness of individual secondary discipline-specialist literacy practice use by improving teacher preparation programs, in-service teacher education, and the roles of administrators and policy-makers. This study contributes to the importance of having secondary-discipline specialists understand discipline-specific text metalinguistic awareness, and has the potential to create classrooms that are more discipline-specific and literacy-rich. Secondary students are required to read a plethora of texts, and by being taught how to engage discipline-specific texts as discipline specialists, they will develop the capacity to read and think as discipline specialists.

Dedication

For my dear husband, Al,

because of his unending encouragement and faith in my ability.

He also selflessly took on extra home responsibilities

to accommodate me as I pursued my EdD.

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“‘For I know the plans that I have for you,’ declares the LORD, ‘plans for welfare and not for calamity to give you a future and a hope’” (Jeremiah 29:11).

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Chapter One: Introduction

In order to be taught successfully, it is necessary to know how to use language to learn; and also, how to use language to participate as an individual in the learning situation. (Halliday, 1969, p. 35)

How can teacher educators, school boards, principals, parents, and students ensure that secondary discipline teacher specialists know how to teach their adolescent learners how to read discipline-specific texts? Halliday (1969), a seminal theorist, revealed some of the answers to this question in the above quote. Teachers, as a part of the learning situation, need to be aware of how they learn and use language. This metalinguistic awareness should improve their communication of language to their students. That seems logical, but it is not as simple as it appears. My research endeavours to help in understanding how to assist secondary teachers (Grades 7 through 12) to be more effective in teaching discipline-specific text reading.

One Teacher's Disciplinary-Literacy Story

My deep desire to help adolescents read was the catalyst that sent me on my postgraduate journey. My Master of Education (MEd) work had two primary foci. The first was to encourage content-based literacy for secondary teachers. *Content-based literacy*, or content area reading, refers to the generic reading skills and strategies needed to understand a text rather than the content itself. The second focus was to improve my understanding of how important it is that teachers teach literacy practices within their core content areas (science, social studies (SS), English language arts (ELA), and mathematics). *Literacy practices* are habitual processes used by readers to understand written language. In the first decade of the 21st century, as I was completing my MEd, depending on the teacher, I found that some teachers resisted the idea of adding literacy practices and responsibilities to teacher instruction. School board in-services, university classes, and several books were available to promote the growth of teachers who were using content-based literacy. These educational opportunities offered teachers a plethora of

generic literacy strategies that were expected to be used in all content areas without adjusting the strategies for the specific discipline or subject.

Over the last number of decades, secondary teachers have seen a strong emphasis on, and the expectation of, teaching literacy practices in core (math, SS, science, and ELA) content areas (Lent, 2016; Ippolito et al., 2019; Howell et al, 2021; Brozo, et al., 2013; Frey & Fisher, 2004) or what I will refer to as disciplines. Years of research have supported the use of content area reading strategies because, as Brozo et al. (2013) explain, the use of these strategies helps in increasing “engagement in reading and learning, improve literacy skills and abilities, and lead to greater knowledge acquisition” (p. 354). The use of content area reading strategies, however, does not tend to teach the nuances of each discipline.

I became challenged and intrigued by content-area literacy when I was hired to teach Grades 8 and 9 ELA. As an inexperienced teacher, it did not take long for me to realize how unprepared I was to teach students how to read and navigate through the ELA curriculum. When I gave my Grade 9 students some old Provincial Achievement Test questions as a midterm reading-comprehension test, half of them failed; this shed light on and magnified my knowledge and ability. Being cognizant of the fact that I needed to teach my young charges how to read, write, listen, view, speak, and represent—the six strands of ELA—the reading aspect of the curriculum confounded me the most. One of my frustrations was that I felt ill-equipped to teach reading to my students even though I had an after-degree in elementary education. This degree had not given me the tools to teach elementary students to read effectively, let alone adolescents. I was also not naïve enough to believe that the poor results on the reading-comprehension test and other assignments and assessments were completely the results of my instruction. These students had had nine years of literacy instruction before they entered my classroom. I wondered

whether prior teachers' limited expertise with literacy instruction was another reason these youths struggled with comprehending. What did I need to do?

I assumed that if the students were struggling with reading ELA content, they would probably be struggling in other content areas. How could we—the teaching faculty at our school—ensure that we were teaching students the reading processes or habits they needed to be successful in all their subjects? As I was dealing with the reading-comprehension conundrum, our school chose a reading comprehension instructional focus; this meant that as a staff, we would concentrate on teaching reading skills in all core classes.

To observe changes in our students' reading abilities, we needed to change or adjust some of our teaching practices. Thomas and Barksdale-Ladd (2000) concluded that if teachers do not make a concerted effort to change, they will fall back to the familiar; this is often the way they were taught. As a staff, we continued to develop our teaching skills and practice through a literacy consultant who gave us direction in how to teach various reading practices, and through the use of a reading program called Comprehensive Assessment of Reading Strategies (CARS) and Strategies to Achieve Reading Success (STARS). This program did not solve our entire student reading-comprehension issues, but it was a tool that, when used with individual student's needs in mind, proved to be valuable.

As I narrowed the focus of my research on adolescent literacy for a Doctor of Education degree, I uncovered the fact that little research had been conducted on how secondary teachers feel or think about how they align teaching content material with literacy practices especially disciplinary literacy. According to the literature (Brozo et al., 2013; Draper, Broomhead, Jenson, Nokes, & Siebert, 2010; Draper, Smith, Hall, & Siebert, 2005; Fang, 2012a, 2012b, 2014; Fang & Chapman, 2020; Fisher & Ivey, 2005; Meyer et al., 2012; Shanahan & Shanahan, 2008, 2012;

Smagorinski, 2015) and my experience, an effective way to help adolescents understand discipline-specific texts is to have teacher subject experts teach discipline-specific literacy practices to their students. Instead of teaching disciplinary literacy, a historic challenge is associated with the idea of teaching generic reading skills in the content areas. The phrase that Gray (1937) coined, “Every teacher being a teacher of reading,” makes many content specialists uncomfortable and has been a highly contested subject for secondary teachers, schools, and school boards since the beginning of the 20th century (Meyer et al., 2012). Generally, discipline specialists are experts in their subjects, not experts in literacy instruction, and have received little or no preservice teacher education to prepare them to teach discipline-specific literacy practices. *Disciplinary literacy* refers to the specific academic language and literacy practices (Fang & Coatoam, 2013; Gee, 2014) that teacher discipline experts use.

My teaching assignments throughout the years have been similar: teaching Grades 7 through 12 ELA along with other courses such as Social Studies 7, 8, and 9 and Health 7, 8, and 9. I have also had the privilege of being trained as a Middle Years Literacy Intervention (MYLI) teacher. MYLI is designed to assist students in Grades 3 through 9 who are struggling and at-risk in literacy learning. The purpose of this program is to increase the possibility that all students will move successfully through school and have a greater chance of graduating from high school. Through MYLI training and implementation in my school, I was able to assist one or two students at a time with intensive literacy instruction and then teach to these students’ core teachers the strategies that will assist them in instruction.

In over 25 years of teaching secondary ELA, I am aware of many other content area teachers who still believe it is only English teachers’ responsibility to teach students how to read and write. At one of my schools, we developed a schoolwide intervention to assist students with

their academic needs, whether that was learning the language for English language learners, improving math understanding, or developing stronger literacy skills in all subjects. Many students needed general reading or writing strategies to help them grow in content areas. A number of teachers were resistant to teaching literacy practices such as inferring, summarizing, or finding word meaning in context. One of the teachers suggested I offer this intervention because I was an expert at teaching these strategies and she was not, so teaching them was not part of her job. I am concerned that this teacher did not take ownership of her need to teach her students the necessary literacy practices that will help them understand the texts within her subject area.

I have also had conversations with science teachers who have said they do not have time to teach their students how to write lab reports correctly. If science teachers are not willing to teach students how to write lab reports, where are they going to learn? An ELA teacher does not have time to teach lab writing along with the ELA curriculum. Is it not all teachers' responsibility to ensure students are learning? Would teaching literacy practices to help students understand and use these literacy practices within the content areas not be part of teachers' instructing responsibilities? How does the educational system communicate this need to all teachers so that they own the responsibility? Why is there still a general resistance to teaching literacy practices within content areas? Does preservice teacher education not prepare teachers to teach disciplinary-literacy practices? Do teachers' beliefs about literacy and literacy instruction and their understanding of the subject area content affect their teaching practice? These reoccurring questions drove me to investigate the issue in more depth. I wanted to determine possible solutions to the resistance and shortage of ownership of secondary teachers' to teaching of disciplinary literacy. By understanding how teachers themselves think as they engage with

their discipline-specific texts, I thought I could identify ways for them to introduce these skills to their students.

At one point, I had an opportunity to provide assistance for the professional development (PD) committee at a high school to understand disciplinary literacy. I facilitated their discussion on what literacy means to them as high school teachers and, specifically, what it means concerning being a discipline specialist, whether in English, math, SS, the sciences, physical education, or career and technology studies (CTS). Some of the results of this discussion were that (a) teachers are more aware than they realized about the literacy needs that subject specialists require to navigate the texts in their disciplines; (b) some educators did not seem to label the thinking process as a literacy task or activity; (c) many of the teachers were not sure how to assist students to navigate through the information they were to learn and create; (d) one English teacher found it difficult to put into words her metacognition as she interacted with the English-specific texts; (e) another English teacher who was worried about below-grade level readers did not know how to teach these students—her frustration resounded as she spoke; (f) when asked about general literacy practice skills such as making inferences, predicting, and summarizing, many did not know what they were, let alone how to teach them, and; (g) when referring to other literacy practices such as sequencing, the math and SS teachers understood that both disciplines use the practices differently. These results point to a need for more specific understanding of discipline-specific literacy and the means to implement this insight in classrooms.

As I worked to improve my understanding of disciplinary literacy, our school district implemented the Districtwide Focus on Reading (DFR) (Edmonton Public Schools, 2016), in which teachers are expected to support students' reading in all subject areas across all grades.

This official change in our district's focus has put literacy at the forefront of many schools' agendas. The DFR requires ELA teachers to identify whether their students are reading at, above, or below grade level relative to the Alberta Programs of Study. Students reading below grade level would be tracked on progress reports and offered literacy support in their schools. Why are not all teachers responsible for determining whether students are reading at, above, or below grade level in all core subject areas? A student can be reading efficiently in ELA but not in science, math, or SS.

In February 2016, I became a secondary literacy consultant. In this position, I influenced the instruction of thousands of students rather than the 160 whom I taught at the school level. When I joined the consultant team, they were in the process of developing resources for the DFR. One of my jobs was to begin to provide illustrations for the EPS Grades 7 through 9 ELA handbooks. These documents contain the reading outcomes for Alberta's Grades 7 through 9 curricula. I also continued working with the high school I previously mentioned. Because of my interactions with teachers in this school, they were beginning to become more aware of how they think and interact with discipline-specific texts; they wanted to be more effective at teaching discipline-specific thinking to their students. During my presentation on a PD day, other high school teachers were given the opportunity to think about and discuss what literacy meant in the context of their disciplines, including English, math, SS, the sciences, physical education, or CTS.

Another one of my consultant responsibilities was facilitating a summer institute called *High Impact Reading Strategies and Practices for Supporting Struggling Junior High Readers*. Teachers were provided with an opportunity to explore ways to support struggling adolescent readers across content areas using Fisher, Frey, and Lapp's (2016) *Text Complexity: Stretching*

Readers With Texts and Tasks as the anchor text. The teachers learned specific instructional strategies designed to meet the needs of a diverse range of students. The institute also taught them strategies that included whole-class, small-group, and one-on-one activities they could adapt to fit the diverse needs of students and diverse situations. Time was given for the teachers to incorporate these key strategies into teacher planning for the school year (Consulting and Resource Services, 2016) and they were encouraged to explore the strategies and ideas from the seminar through the lens of discipline specialists.

As Alberta Education looks at creating new curriculum, it would be beneficial for it to include disciplinary literacy. Having discipline-specific literacy embedded in each subject area is essential to students' success as discipline experts. The idea is to help students think and act as discipline specialists (Moje & Lewis, 2007); one of the ways to do that is to have them be aware of how they read as discipline specialists. My study will investigate the metalinguistic awareness of secondary discipline-specialists. This awareness may assist teachers to implement a more disciplinary literacy-focused curriculum. I have clarified some specific terms in the next section.

Definition of Terms

There are many definitions of *literacy*, but for this study, I will use the five-component description of Frankel et al. (2016), because it is a comprehensive definition. Frankel et al.'s first component is that literacy is a "constructive, integrative, and critical process situated in social practices" (p. 7). Second, Frankel et al. explain that the fluent reading aspect of literacy is "shaped by language processes and contexts" (p. 7). Third, literacy is "strategic and disciplinary" (p. 7). Fourth, literacy involves motivation and engagement. The fifth component of literacy is a "continuously developing set of practices" (p. 7). Frankel et al. conclude that literacy is "the process of using reading, writing, and oral language to extract, construct, integrate, and critique

meaning through interaction and involvement with multimodal texts in the context of socially situated practices” (p. 7) (Barton & Hamilton, 1998; Gee, 2014; Vygotsky, 1978, 2012). Literacy is complicated and multi-faceted.

An essential aspect of literacy is *language*. Language includes both oral and written systems. Within each category, language is productive and receptive. In oral language use, the productive component is speaking and the receptive is listening. With regard to written language, Goodman (1996) identifies the act of writing as one of the productive components and reading as one of the receptive components. For most readers (except for the visually impaired), reading is used to comprehend written language, which Goodman (1996) describes as graphic shapes on flat surfaces. According to Goodman (1988), there is an “essential interaction between language and thought in reading” (p. 12). Goodman (1996) suggests that oral language and written language are parallel components of a language system, and the human mind executes comprehension of written text via our eyes, except for the visually impaired, and via our ear for all but the deaf.

Literacy practices is defined by Barton and Hamilton (1998) as “the general cultural ways of utilizing written language which people draw upon in their lives; ... what people do with literacy” (p. 6). Barton and Hamilton (1998) explain that literacy practices directly involve values, attitudes, feelings, and social relationships and are therefore difficult to observe in their entirety. Corresponding with Perry (2012), specifically with relation to secondary school and the literacy with which teachers and students interact, literacy practices are specific to the language, culture, attitudes, historical context, and social relationships that occur within discipline-specific classrooms. Literacy practices involve what it means to engage with reading, writing, speaking, listening, viewing, and representing. Some of the literacy practices specific to this study refer to

the reading skills, strategies, and thinking processes that a reader uses to understand discipline-specific texts.

Afflerbach, Pearson, and Paris (2008) define *reading skills* as “automatic actions that result in decoding and comprehension with speed, efficiency, and fluency and usually occur without awareness of the components or control involved” (p. 368). Reading skills refers to literacy practices that the reader uses automatically. Afflerbach et al. define *reading strategies* as “deliberate, goal-directed attempts to control and modify the reader’s efforts to decode text, understand words, and construct meaning” (p. 368). *Reading strategies* are literacy practices that the reader consciously employs to understand a text. *Thinking processes* refers to reading strategies or skills—depending on automaticity—used while trying to understand what is being learned. Further discussion about reading skills, strategies, and thinking processes appears in Chapter Two.

Moje (2015) describes *disciplines* as “domains and cultures in which certain kinds of texts are read and written for certain purposes and thus require certain kinds of literacy practice” (p. 255). For this research, the disciplines chosen are the school-specific disciplines of sciences (biology, physics, and chemistry), SS, ELA, and math.

Content areas and *subject areas* are interchangeable terms often found in schools to indicate the course in which students are studying. For example, ELA, biology, chemistry, SS, mathematics, and statistics are some of the content or subject areas found in secondary classrooms. According to Wolsey and Lapp (2017), these subject areas are “often put into silos by grade and course number” (p. 7). Keeping the content within these subject areas helps in the organization of the information and in how students move through the school system.

Even though *content-based literacy* has the word “content” in it, content-based literacy refers to the generic literacy practices—strategies and skills—needed to understand a text, rather than to the content itself. Content-based literacy instruction promotes the ability to interact with content or subject texts using various similar generic literacy practices in all subject or content areas (Johnston et al., 2016; Marlatt, 2018). This instruction does not take into consideration the particular subject-, content-, or discipline-specific nuances or reading needs, but helps struggling readers become aware of the literacy practices that more competent readers use expertly (Shanahan & Shanahan, 2012). Gillis (2014) explains “content area reading seems to impose generic reading strategies on content-specific text” (p. 615). Brozo et al. (2013) concur, and explain that content-based literacy imposes generic literacy practices onto texts.

Many researchers (Cisco, 2015; Brozo et al., 2013; Faggella-Luby et al., 2012; Fang & Coatoam, 2013; Hynd-Shanahan, 2013; Shanahan & Shanahan, 2008) define *generic reading strategies* as reading strategies that enable readers to understand general texts. These strategies include self-monitoring, making connections, reading for the main idea, finding word meaning from context, summarizing, generalized note-taking, concept mapping, comparing and contrasting, inferring, synthesizing, analyzing, decoding, visualizing, questioning, annotating, and sequencing (Wineburg & Reisman, 2015; Cisco, 2015; Fang & Coatoam, 2013; Gilles et al., 2016; Hynd-Shanahan, 2013; Faggella-Luby et al., 2012; Allen, 2000).

Draper et al. (2010) defined *disciplinary literacy* as “the ability to negotiate (e.g., read, view, listen, taste, smell, critique) and create (e.g., write, produce, sing, act, speak) in ways that other members of the discipline (e.g., mathematicians, historians, artists, [scientists]) would recognize as ‘correct’ or ‘viable’” (p. 30). *Discipline experts* are teachers who have been educated in and learned a specific academic subject: science (chemistry, physics, or biology), SS,

ELA, or math. *Discipline-specific reading* refers to reading texts that are discipline-specific. Brozo et al. (2013) explain that when reading discipline-specific content, “the text itself and the goals for reading the text dictate the reading processes” (p. 354). *Discipline-specific reading strategies* are the strategies needed to successfully read discipline-specific texts. The text determines the reading strategies required for comprehension.

Wade and Moje (2000) have defined *texts* as “organized networks that people generate or use to make meaning either for themselves or for others” (p. 610). The term *texts* includes a broader idea that refers to readings or viewings from textbooks, articles, websites, videos, laboratory explanations and write-ups, mathematical problems, and other students’ texts (McLaughlin, 2008; Wells, 1990). Coiro (2003) and Kress (2003) both agree that texts can be categorized as traditional print-based, digital, and multimodal. For my research, *texts* refers to the passages, textbooks, writings, websites, or symbols with which learners need to interact to be able to comprehend discipline-specific information.

Statement of the Problem

Extensive research exists on the importance of teaching reading strategies to secondary students in the core content, subject areas, or disciplines. Numerous reading strategies are available to secondary discipline specialists to teach students how to navigate successfully through the content texts and information (Brozo et al., 2013; Fisher & Frey, 2004, 2008; Harvey & Goudvis, 2007, 2017; Shanahan & Shanahan, 2008; Vacca et al., 2005). Even though these strategies are available, many secondary students still struggle with comprehending discipline-specific texts. A reason for this problem must exist. Research has shown that one of the causes is content-literacy dualism (Brozo et al., 2013; Draper et al., 2010; Moje, 2008; Shanahan & Shanahan, 2012), which has disengaged secondary-content or subject-area teachers from

teaching content-based literacy in their areas because they are not trained literacy specialists; rather, they are discipline or subject specialists who are experts in disciplines.

The shortage of discipline-specific literacy training for preservice and practicing teachers is one reason many teachers are ill-equipped to teach content materials effectively; this can leave many students struggling to understand content courses. Also, some teachers do not take ownership of teaching their disciplinary-literacy skills. Teachers' beliefs and mindsets about literacy and learning within subject areas might also be a reason why some teachers are not motivated to teach disciplinary literacy. Moje (2008) and Gilles et al. (2016) concur that if teachers are aware of the reading strategies they use as they read discipline-specific texts, they may be more inclined and better able to embed those strategies into their teaching.

Pedagogical Issues Leading to This Study

Two of the primary issues that contribute to limited disciplinary-literacy instruction in secondary discipline classrooms are content-literacy dualism and teacher practice resistance.

Content-Literacy Dualism

Many core teachers are overwhelmed with the prospect of being literacy experts as well as subject experts, and therefore tend to back away from the literacy-instruction expectation (Ian O'Byrne, et al. 2021; Hinchman & O'Brien, 2019; Alvermann & Moje, 2013; Fisher & Ivey, 2005; Smagorinski, 2015; Malmström & Pecorari, 2021). Recent years have seen controversy over content-area literacy and disciplinary literacy, and the struggles of teachers to implement instructional literacy practices. Brozo et al. (2013) noted that "there has been an artificial literacy-content dualism created which hinders healthy discussion about how to effectively teach student literacy in the content classroom" (p. 353). These authors stressed the importance of teaching at the centre of content-based reading and disciplinary literacy. Teaching content-area

literacy, as well as disciplinary literacy, is not new, for educators and scholars have been grappling with the implementation of literacy practices since the early 1900s (Moje, 2008). Both help students to comprehend their studies.

According to Moje (2008) and Shanahan and Shanahan (2012), the notion that every teacher is a teacher of reading has become so commonplace in the content-area literacy vernacular that it has become ineffective and outmoded. Some sort of balance is required between teaching content-area literacy and disciplinary literacy. Shanahan and Shanahan (2012) explained the difference between content and disciplinary literacy:

Content area literacy focuses on study skills that can be used to help students learn from subject matter specific texts. Disciplinary literacy, in contrast, is an emphasis on the knowledge and abilities possessed by those who create, communicate, and use knowledge within the disciplines. (p. 8)

Brozo et al. (2013) observed a disconnect between literacy specialists and discipline-area teachers. Dean (2016) points out that one of the problems is that many secondary teachers have not had any discipline-specific literacy practice courses in teacher certification programs. The literacy practices presented to teachers need to include the flexibility to pick and choose the practices that work best within their disciplines and with the students in their classes.

Disciplinary literacy stresses the specific literacy practices that are required in a particular content-area discipline (Moje, 2008). According to Shanahan and Shanahan (2012), “Disciplinary literacy emphasizes the unique tools of the experts and discipline used to engage the work of that discipline” (p. 8). Teachers of content need to be experts in the discipline as well as being aware of and proficient in teaching the literacy practices that students need to be able to comprehend the particular texts. Brozo et al. (2013) argued “the generic strategy approach can,

indeed, be of infinite value to students when content area teachers and literacy specialists engage in thoughtful dialogue about how to contextualize the strategies” (p. 355). Most of the discipline-specific texts that students encounter require that they read and comprehend the texts so they can successfully navigate through the content area.

Instead of being at odds with one another, content-area or discipline teachers and literacy specialists should collaborate (Fang & Coatoam, 2013). Both parties can contribute their expertise to develop lessons, learn from each other, and not only teach content, but also build discipline-specific literacy practices. The collaboration will build the capacity of both discipline and literacy specialists. The idea of teaching what is needed to understand the discipline is not new. Even in 1925, Gray maintained that “each teacher who makes reading assignments [in their content area] is responsible for the direction and supervision of the reading and study activities that are involved” (p. 71). According to Hinchman and O’Brien (2019), a problem still exists with effective disciplinary-literacy instruction. The content-literacy dualism is one reason why secondary discipline specialists tend to resist the teaching of literacy practices.

Teacher Practice and Resistance

Despite the abundance of resources for content-area and disciplinary literacy, many core content (science, SS, ELA, and math) teachers expect ELA educators to be the sole experts and proprietors in teaching reading, writing, and other literacy practices (Gilles et al., 2016; Malmström & Pecorari, 2021). As Fine et al. (2011) maintain, for content area teachers to teach reading skills in their classes, they need to believe it is essential.

Peter Smagorinsky, a distinguished research professor of English education and an expert in literacy teaching and learning, had comparable experiences with his teaching peers.

Smagorinsky (2015) gives two examples that he experienced of resistance to teaching literacy in

other disciplines. When Smagorinsky was teaching English from 1976 to 1990, a history teacher wondered why his students were not citing references properly in history papers, questioning what was happening in Smagorinsky's English department. A district-level curriculum coordinator stated to Smagorinsky, "Writing is writing is writing" (2015, p. 141); this means that writing is the same, no matter the subject or purpose. A lack of understanding exists that we need to teach discipline-specific literacy.

ELA teachers can successfully help students become capable writers in content areas by teaching them the general skills they need to write in a coherent way, as well as the knowledge to be able to change the form of the writing to fit its purpose and audience (Alvermann & Moje, 2013; Smagorinsky, 2015). For example, the form of a poem is different from that of a science lab report, a solution to a math word problem, or an SS essay in which students debate an issue. According to Cantrell, Burns, and Callaway (2009), "A resistance stems from a number of factors, including middle- and high-school traditions and cultures, teacher beliefs about the roles and responsibilities of content area teachers, and content teachers' lack of confidence in their own preparation and literacy teachers" (p. 77). Cisco (2016) makes the point that some adults did not receive enough high school education that emphasized content area reading instruction. This lack of education could be later rectified by the provision of reading support in content areas through university tutoring or academic support programs. Fine et al. (2011) point out that "Even when teachers have a sense of efficacy to teach in their content, they may have a low sense of efficacy when it comes to teaching reading to struggling or unmotivated students" (p. 27).

Many math teachers have strongly resisted teaching literacy practices in content areas. Cantrell et al. (2009) found that this is true because math teachers find it problematic to understand how literacy is pertinent to their discipline (p. 84). The literacy practices required to

understand math tend to vary from those in the other three content areas, primarily because of the use of numerical symbols in math language. Science likewise involves the use of a number of symbols in texts, especially in chemistry and physics; however, the sciences also involve reliance on reading large volumes of information to understand them.

As with any learners, teachers require scaffolding (Vygotsky, 1978; Bruner, 1975, 1978; Benko, 2012) to improve their ability, understanding, and implementation of content-area or discipline-area literacy strategies. They require time and space to understand the literacy needs of their discipline. Having to teach too many strategies all at once can overwhelm teachers. If school staff members agree to implement a small number of strategies that enhance the disciplinary literacy in their classes, they are much more likely to teach them. Every time teachers learn new strategies, they add to their educational toolbox and have access to those tools when they need them. Both the content-literacy dualism and teacher resistance to teaching literacy in classes were strong driving forces in my choice of this research topic.

Purpose of the Study

The purpose of this study was to explore secondary discipline specialists' reading of discipline-specific texts. Keeping in mind the issues of both content-literacy dualism (Brozo et al., 2013) and teacher resistance (Cantrell et al., 2009), I had a strong desire to better understand how to enhance secondary teachers' willingness, emerging awareness, and understanding of their discipline-specific literacy practices. I wanted to identify tools that would assist secondary teachers to more effectively teach students how to navigate discipline-specific texts. These tools would hopefully help both teachers and students to be effective in discipline-specific literacy use: teachers as educators and students as learners. As Shanahan and Shanahan

(2008) state, “the nature of the disciplines is something that must be communicated to adolescents, along with the ways in which experts approach the reading of text” (p. 51).

Research Questions

The main research question guiding this study was:

How do secondary discipline-specialist teachers engage with discipline-specific texts?

Sub-questions were:

1. What metacognitive literacy practices do discipline specialists use as they engage with discipline-specific texts?
2. What impact does background knowledge have on discipline-specialist comprehension of their discipline-specific texts?
3. What do discipline teachers recommend as supports to their communication of the thinking processes of discipline-specific reading?
4. How do discipline teachers believe they can support students to think as discipline specialists, as they read discipline-specific texts?

According to Yin (2014) these main and sub-questions drove my thinking as I conducted this multiple case study research; they are referred to my *mental line of inquiry* (p. 239).

Significance of the Study

The fundamental difference between this research and the many content-based literacy studies is that, in the latter, researchers investigated how to use generic literacy practices to instruct content-area information without considering the discipline-specific literacy needs (McArthur, 2012). Secondary discipline-specific studies have looked more at the teaching of discipline-specific literacy without including an in-depth understanding of personal metalinguistic awareness. Additionally, not many disciplinary literacy studies focus specifically

on secondary teachers; several studies focus more on pre-service teachers, undergrad and grad students, and/or professor understanding of texts (McArthur, 2012; Shanahan et al., 2011; Shepherd & van de Sande, 2014; Cisco, 2016; Cheung, 2009). My research, however, explores how secondary discipline specialists engage discipline-specific texts as they use literacy practices to understand the content that they learn and teach successfully. Most secondary discipline specialists can read discipline-specific texts effectively and efficiently, so how can they be given the tools to communicate their discipline-specific reading prowess to their students? Each teacher discipline specialist needs to teach literacy practices in a way that is conducive to learning discipline-specific texts. My thinking was that if teachers are metalinguistically aware of how they understand and create discipline-specific texts, this awareness could enable them to communicate their metacognition to students, to help these young minds better understand and think as discipline specialists.

The importance of this study is far-reaching in the disciplinary-literacy understanding and pedagogical practice of secondary teachers. The findings of this research build on previous inquiries into how to support teachers to communicate discipline-specific literacy practice thinking to students, so pupils can effectively use these practices to navigate through and understand content information. The need to teach literacy practices to students does not end once a student has started Grade 7. Each specific discipline has definite literacy practices that students must use to grasp the content information. If teachers can understand how they think as experts in their discipline, they have more tools to teach their young charges more effectively. As noted by Carson (1986), research in this area will positively impact teachers' lives and will not be detached from the classroom; my research is significant because it provides further scholarly and pedagogical insights. Scholarly significances include a further understanding of the

cognizance of secondary discipline specialist literacy practice use and of using think aloud as a research tool. Pedagogical insights consist of creating a greater awareness of individual secondary discipline-specialist literacy practice use by improving teacher preparation programs, in-service teacher education, and the role of administrators and policy-makers.

Study Context

The focus of this study is secondary discipline specialists who teach adolescents. There is a difference between adolescent literacy instruction—divisions 3 and 4 (Grades 7 through 12) and child literacy instruction—divisions 1 and 2 (kindergarten (K) through Grade 6). The common assumption of literacy instruction is that in division 1 (K through Grade 3), students are taught to read, whereas, in division 2 (Grades 4 through 6) and up, students are expected to read to learn. As students mature, they are expected to be more independent in their ability to navigate through texts. Being able to teach literacy practices is a necessity for secondary teachers. Teachers require pedagogical content knowledge (Shulman, 1986) to recognize which literacy practices and strategies are required to effectively teach the content within subjects.

My study occurred in Alberta, a prairie province in western Canada. Alberta has consistently ranked higher on international assessments of education and skills. According to The Conference Board of Canada (2020), in 2014, Alberta ranked fifth among the other provinces and 15 international peer countries. Alberta's education system earned a B in its education and skills, just below Japan, Finland, British Columbia, and Ontario. The Government of Alberta (2020) explained that the 2013 PISA results stated that "83% of Alberta respondents are able to complete the computer-based assessment (above the OECD average of 74%)." From the same 2013 results, the Government of Alberta (2020) maintained that Alberta is the only Canadian jurisdiction with more people in the "highest levels of proficiency in literacy,

numeracy, and computer literacy skills.” The outcomes from the same study also state “the mean score for Alberta’s youth aged 16 to 24 is at the OECD average in literacy and numeracy.”

Teachers in most Alberta school districts are expected to teach discipline-specific literacy in diverse and large classrooms. Secondary teachers have been asked to meet the needs of all students in increasingly challenging teaching environments. Class sizes have increased, the number of students with various special needs have increased, the number of culturally and linguistically diverse (CLD) students have increased, but time and budgets have not increased to assist teachers to plan, program, and implement instruction for the changing needs in the classroom. Insufficient funding, increased classroom populations, and diverse student needs afford teachers less time to plan, program, and implement the use of literacy practices to accommodate the changing needs in their classrooms, which puts a remarkable strain on educators.

Even though Albertans tend to have average to above-average literacy skills, many Alberta students still struggle with the ability to communicate—whether in reading, writing, viewing, listening, speaking, or representing. The limited expertise with literacy instruction might partially result from their teachers’ lack of ability to teach disciplinary-literacy practices. The Alberta Program of Studies for each subject cites strong literacy practices that the government expects teachers to teach (Alberta Education, 2000, pp. 1–95; Alberta Education, 2003, p. 5; Alberta Education, 2007a, p. 5; Alberta Education, 2007b, p. 10). It is essential that we help our struggling readers be more literate, so they can have a more fulfilling life and be positive contributors to our society. My research is an attempt to find some possible solutions to assist teachers to teach their discipline content more effectively and students to be able to read more comprehensibly in the disciplines.

Overview of the Study

In Chapter Two I present theories and literature that serve as the theoretical and conceptual framework of my study. Chapter Three provides a description of the methodology—multiple case study—and lays out information, including participant recruitment, data collection, and analysis and interpretation. In Chapter Four, I demonstrate how the participants in this research engaged with discipline-specific texts. I present quotes from interviews and think-aloud data, and categorize the quotations into a number of sections. In Chapter Five, I communicate my interpretations of the research data concerning how secondary discipline specialists engage with discipline-specific texts. The final chapter explains the contributions my research makes to scholarship and pedagogy, followed by a reflection on my research and then further research ideas. I conclude the chapter with closing thoughts on what I learned through this EdD research journey.

Chapter Two: Theoretical Frameworks and Literature Review

A sociocultural perspective on teacher practice provides the basis for a systematic, comprehensive, and theoretically robust framework that accounts for the social dimension of thought and knowledge: a perspective now recognized as essential for understanding how teachers come to think, know, and behave in the ways that they do, as historical and sociological agents within larger contexts for practice. (Cross, 2010, pp. 449–450)

The above quote by Russell Cross (2010) introduces the sociocultural perspective of how teachers think, know, and behave within broad contexts, bringing with them historical experiences that influence teacher pedagogical practice. This chapter contains the theoretical and conceptual frameworks as well as a literature review, all of which reflect a sociocultural perspective. First, I discuss the theoretical lenses which framed my research, highlighting theorists Lev Vygotsky, James Gee, and Louise Rosenblatt. In the second section I highlight the literature that grounds my research, focusing on the following aspects: a conceptual underpinning of disciplinary literacy; reading in the disciplines; teacher content knowledge (TCK); metacognition; and explanations of reading skills and strategies, thinking processes, and background knowledge.

Theoretical and Conceptual Framework

Theory informs readers about the contents of the study and assists researchers to support and interpret findings and link them to other works. According to Casanave and Li (2015), theories and concepts explain or justify why and how the study is being done. Bogdan and Biklen (2007) explain that theory “helps data cohere and enables research to go beyond an aimless, unsystematic piling of accounts” (p. 24). Abend (2008) points out that the theoretical framework explains the meaning, nature, and challenges related to the study. Becker (1998) explains that “the conceptual framework of your study [is] the system of concepts, assumptions,

expectations, beliefs, and theories that supports and informs your research” (p. 33). This research used both theoretical and conceptual frameworks to frame the inquiry.

As I pursued my research on how secondary teacher discipline specialists engage with discipline-specific texts, sociocultural theory was the lens used to plan and implement this study as well as to analyze and interpret the data. These frameworks demonstrate how existing theory and research helped in the understanding of the social and cultural context in which this study is embedded. I inquired into teachers’ learning, which indirectly impacts adolescents’ learning; these are sociocultural activities. The frameworks will highlight aspects of three theorists: first, Vygotsky and his sociocultural learning theory (1981, 1978); second, Gee and his discourse theory (2002, 2013, 2014); and third, Rosenblatt and reader response theory (1982, 1988, 2013).

Sociocultural Perspective

Humans are social beings who are born into families and grow and mature within a broad social context. According to Wertsch (1991a), “The basic tenet of the sociocultural approach to mind is that human mental functioning is inherently situated in social interactional, cultural, institutional, and historical contexts” (p. 86). Sanderson (2010) defined sociocultural theory as “a perspective describing people’s behaviour and mental processes as shaped in part by their social and/or cultural contact, including race, gender, and nationality” (p. 19). The implications of sociocultural theory are evident in every aspect of life. People are mentally, emotionally, physically, and spiritually multifaceted. We can view each of these facets through a sociocultural theoretical lens. Because sociocultural theory examines social interaction as central to human development and activity, it is the lens through which researchers in many disciplines view their work, including anthropology, sociology, psychology, linguistics, second-language acquisition, and education.

Sociocultural learning theory is complex. According to Wertsch (1990, 1991a), sociocultural learning theory explains the hypothesis that individual higher-order mental functioning has its roots in social relations. Tools and signs mediate both social and individual psychological activity—semiotic mediation—which is also explained in sociocultural theory.

My research explores literacy and literacy practices—sociocultural events—as they relate to reading. Street (2006) confirms the sociocultural aspect of literacy by explaining that literacy is ideologic rather than autonomous in that it is not neutral, universal, or simply technical. Literacy, Street describes, is culturally sensitive because it varies from one circumstance to another and is “always embedded in socially constructed epistemological principles. It is about knowledge: the ways in which people address reading and writing are themselves rooted in conceptions of knowledge, identity, being. It is also always embedded in social practices” (p. 2). Vygotsky’s sociocultural learning theory exemplifies the importance of human experience and interaction as they gain knowledge.

Vygotsky’s Sociocultural Learning Theory

Lev Vygotsky (1981), a Russian psychologist, was the father of sociocultural learning theory. He believed that “all higher mental functions are internalized social relationships” (p. 164). He did not think that learning occurs merely as an outcome of maturation, but rather because of interaction in the social world (Wells, 1994). Learning takes place within a school, in a sociocultural context with interactions between students and learned others—usually teachers or other students—who have a better understanding of what is being learned or taught. Vygotsky (1981) stated interesting insights regarding functions in child development:

Every function in the child’s cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside

the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals. (p. 57)

One of these functions is learning.

Higher-order thinking functions have their roots in social relations. This phenomenon can be first observed in the relationship between children and their caregivers—mothers, fathers, nannies, daycare workers (John-Steiner & Mahn, 1996). Both the interpsychological and the intrapsychological development (Vygotsky, 1978) of children are situated in social interaction. Children unconsciously learn through their interactions with others and their context—whether that be language or everyday tasks (John-Steiner & Mahn, 1996). They synthesize this learning and add it to their growing understanding of self and the world.

Vygotsky's (1981) knowledge building and understanding (John-Steiner & Mahn, 1996) demonstrate that tools and signs mediate both social and individual psychological activities. The tools and signs to which Vygotsky (1981) referred include “language; various systems of counting; mnemonic techniques; algebraic symbol systems; works of art; writing; schemes, diagrams, maps and mechanical drawings; all sorts of conventional signs and so on” (p. 137). To know how to use each of Vygotsky's signs and tools, learners must understand the words and symbols connected to them. Vygotsky (2012) stated that “real concepts are impossible without words, and thinking in concepts does not exist beyond verbal thinking. That is why the central moment in concept formation, and its generative cause, is a specific use of words as functional ‘tools’” (p. 115). Wells (1999) notes aspects of children's learning:

By participating in the conversations that accompany and grow out of the everyday activities in which he or she is involved together with other members of the culture, the

child learns to use the semiotic tool of language, which enables him or her to “connect” with other people; at the same time, and by virtue of the mediating role that conversation plays in these activities, the child simultaneously “assimilates the experience of humankind,” as this is encoded in the semantic system of the culture’s language. (pp. 19–20)

Whatever a person learns, language is at the center of the learning, and, of course, language is at the center of literacy.

Vygotsky’s (1978) explained the use of genetic or developmental analysis to understand the origins and transitions of phenomena by focusing on their interconnectedness. To understand mental processes requires an understanding of how and where the learning takes place. Vygotsky emphasized how vital it is to focus more on the process of higher learning than on the product itself. Learning occurs in society and in culturally moulded settings. As historical circumstances continuously change, so do the contexts and learning opportunities (John-Steiner & Mahn, 1996; Offord, 2005). No general schema can entirely characterize the changing dynamics between the inner and outer facets of development (John-Steiner & Soubberman, 1978). When studying the thinking and learning that take place in secondary discipline-specific classrooms, researchers must consider the internal and external aspects of development.

According to Wells (1994), Vygotsky did not believe that learning occurs simply as an outcome of maturation, but that it is a result of interactions in the social world. Wertsch (1984) referred to this context as a situation that needs to be defined. Wertsch (1984) defines “situation” as “the way in which a setting or context is represented—that is, defined—by those who are operating in that setting” (p. 8). The teacher and the learner each have a representation of the

situation's objects and events, and this representation influences the interactions and learnings that take place.

As adults and adolescents continue to develop language use and understanding, they do so in a social manner. Vygotsky's (1978) zone of proximal development (ZPD) is central to this sociocultural learning theory, and his three components—social sources of development, semiotic mediation, and genetic analysis—are involved in it.

Zone of Proximal Development. In education and educational research, Lev Vygotsky's (1978) ZPD is well known and widely applied (Bonk & Kim, 1998; Chaiklin, 2003; John-Steiner & Mahn, 1996; Warford, 2011; Polly & Byker, 2020; Newman & Latifi, 2020). Vygotsky (1987) proposed, "What the child can do in collaboration today he will be able to do independently tomorrow" (p. 211). The ZPD, as Vygotsky (1978) defined it is "the distance between the actual developmental level as determined by independent problem solving and the level as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). Tharp and Gallimore (1988), Bonk and Kim (1998), and Warford (2011) agreed that even though Vygotsky originally applied the ZPD to younger school-age students, it can be applied to all learners—children, adolescents, or adults. Warford explained that the significant difference between the application of ZPD to adults and children is that adults have a higher number of prior experiences that affect their learning (pp. 252–253). The ZPD is a concept that helps teachers to understand what students—child, adolescent, or adult—can become.

Children's performance capacity within the ZPD (Vygotsky, 1978) is made up of what Tharp and Gallimore (1991) identified as four stages: expert other-assistance (p. 48), self-assistance (p. 51), internalization, i.e., fossilization or automatization (p. 53), and recursion, or de-automatization (p. 54). Kadri et al. (2017) views the ZPD as a mutual place to learn; where

the learner and the capable other learn from each other. The implication, Kadri et al. (2017) explain, is “NOT that a developed (adult) mind meets an underdeveloped (childlike) mind, but that they are precisely different minds that meet” (p. 672). Zuckerman (2007) defines ZPD

as a time or place of the generation and establishment of interactions of a kind that allow for the possibility of the “meeting” of different experiences, different methods of comprehending those experiences, and different forms of mediation that alienate their material content from their subjective quality. (p. 50)

Zuckerman also views the ZPD as a mutual place to learn.

Although most research on the ZPD (Vygotsky, 1978) and its use have focused on the learning of children, the concept can also be applied to adults, particularly teachers (Polly & Byker, 2020; Fani & Ghaemi, 2011; Tharp & Gallimore, 1988; Warford, 2011). Warford (2011) explained in what he called the *zone of proximal teacher development* (ZPTD) that educators proceed through the same stages as children do, except that the first two stages are reversed. This reversal is because teachers have had prior learning experiences that affect the learning situation, and their background knowledge and understanding must be respected. Warford explains, “The core wisdom of a Vygotskian [*sic*] approach [to learning] is the idea that learning leads to development” (p. 254). The technique of prolepsis demonstrates this; it involves teaching in a way that assumes that learners know more than they actually do. Warford also explained, “proleptic instruction serves the ZPD by exploring the optimal distance between actual and potential development” (van Lier, 2004, p. 155, citing Lewin, 1943) (p. 254). Dassa and Derosé (2017) found that teaching within the ZPTD assisted their pre-service teachers to accommodate new material into conceptual knowledge (p. 104). Other scholars (De Beer & Gravett, 2020;

Jafar et al., 2021) used ZPTD, which was valuable in the research and learning of other pre-service teacher research.

For learning to take place, the ZPD requires the modelling and imitation of a tutor or learned other. Bruner (1975, 1978) called this assistance with learning *scaffolding* (Searle, 1984). He explained that learning would take place if social structures are present to build on children's understanding and abilities. In scaffolding, the information is initially introduced more simply, and its complexity is increased as learners continue to interact with and learn about the new information. As more demanding aspects of the new learning challenge students, they are encouraged, as learners, to problem-solve independently. To attain new learning and skills requires scaffolding, which consists of intentionally constructed, supportive interactions between teachers and learners. Fournier and Graves (2002) defined scaffolding as "providing support to help learners bridge the gap between what they know and can do and the intended goal" (p. 31). For students of any age to learn, tutors or learned others must use scaffolding (Benko, 2012; Bonk & Kim, 1998; Brown, 2007; Fournier & Graves, 2002).

Fani and Ghaemi (2011) describe the use of *self-scaffolding* where teacher-learners use literary sources to learn rather than via interactions with other persons. Literary sources can include dictionaries and textbooks, as well as multimodal sources. Literate adults become able to manage their ZPD as they interact with both people and literary sources, internalizing their learning.

As a researcher, I used sociocultural theory from an educational perspective of learning as a dynamic development of making meaning and unravelling problems that occur in and transform social milieus (Teemant, 2005; Tharp & Gallimore, 1988). Hansman (2001) explains that within sociocultural models, learning not only happens within the head but is also "shaped

by the context, culture, and tools in the learning situation” (p. 45). My research focused on literacy learning and thinking, specifically reading and various interactions that occur while adult readers interact with discipline-specific texts. Newman and Latifi (2020) point out that Vygotsky’s sociocultural theory “takes into consideration almost all the relevant factors essential for teacher development including *cognitive, affective, social, and contextual*” (p.10). I observed teacher thinking and behaviour through a sociocultural lens (De Beer & Gravett, 2020; Jafar et al., 2021; Shah & Rashid, 2016; Bonk & King, 2012; Bonk & Kim, 1998; Warford, 2011; Polly & Byker, 2020; Fani & Ghaemi, 2011; Tharp & Gallimore, 1988).

Several social interactions occur in the social world of the secondary discipline-specific classroom. Teachers create and foster an environment that nurtures the social interactions, both between themselves and students and among students. The learning occurs partly because of the social context. Sociocultural learning theory is based on the foundation that learning is social and that social interface between teachers and peers helps students engage in culturally meaningful tasks (Teemant, 2005; Polly & Byker, 2020; Fani & Ghaemi, 2011; Tharp & Gallimore, 1988; Warford, 2011). The classroom is a paradoxical context, for it is a closed milieu in which teachers create environments for the learning of a specific subject, but every person in the classroom—teacher and students—brings his or her social background and understanding, his or her milieu, which also makes the classroom an open environment. Wertsch (1991b) agrees that sociocultural theory provides a lens through which to observe and analyze not only the intricate interactions and learning, but also the social context in which they occur.

Gee’s Discourse Theory

James Gee is a respected sociocultural theorist and researcher who has worked in psycholinguistics, discourse analysis, sociolinguistics, bilingual education, and literacy, and was

a pioneer in discourse theory. According to this theory, humans are social creatures who thrive on social interaction and dialogue, conversation, or discourse through a lens of socially meaningful identities (Gee, 2014, p. 25). The core of communication is language, and through language, humans can say, do, or be. Gee explained that this interaction and way of being is what he called discourses.

Through language, people can communicate in a variety of ways. To do so requires a language base from which to transfer their intended information. Gee (2002) calls this language discourse:

Discourses are characteristic (socially and culturally formed, but historically changing) ways of talking and writing about, as well as acting with and toward, people and things (ways that are circulated and sustained within various texts, artifacts, images, social practices, and institutions, as well as in moment to moment social interactions). (p. 121)

These discourses occur in every situation and interaction.

Gee (2013) separated human discourses into two types: little “d” discourses and big “D” discourses. The former refers to general language in use, which is everyday language. The latter occurs when people have been socialized in particular contexts:

to learn new social languages and genres—at the level of being able to produce them and not just consume them. A Discourse integrates ways of talking, listening, writing, reading, acting, interacting, believing, valuing, and feeling (and using various objects, symbols, images, tools, and technologies) in the service of enacting meaningful socially situated identities and activities. (p. 143)

As people interact with each other using discourses (language in interaction in context), they are “enacting and recognizing socially significant identities” (Gee, 2014, p. 25). Gee (2014)

also defined a Discourse as “a ‘dance’ that exists in the abstract as a coordinated pattern of words, deeds, values, beliefs, symbols, tools, objects, times, and places and in the here and now as a performance that is recognizable as just such a coordination” (p. 53). When people interact using a specific language to fit a specific situation, they are using Discourses.

In this research, I explored secondary teacher discipline-specific language use and understanding of that language while reading discipline-specific texts. Each discipline-specific classroom context has its content-specific Discourse that facilitates communication about that subject (Moje et al., 2000). Science, SS, ELA, or math classes each have several Discourses that facilitate learning and communication within that class. Gee (2014) explains that *recognition* is the key to Discourses. He points out

If you put language, action, interaction, values, beliefs, symbols, objects, tools, and places together in such a way that others recognize you as a particular type of who (identity) engaged in a particular type of what (action), here and now, then you have pulled off a Discourse. ... Whatever you have done must be similar enough to other performances to be recognizable. (p. 52)

Discipline-specific reading Discourses include those used by teachers and students, and can be complex and tentative, depending on what the teachers and the students bring to the class.

Neugebauer and Blair (2020) support that each person involved in a classroom is not an empty vessel but has background knowledge, interests, and focus. Croce and McCormik (2020) point out that language can be very specific and can vary from class to class. The Discourse can also sound the same but have different implications, such as sequencing, that is, following a particular order or pattern (Mpofu & Maphalala, 2020). Such language differences and similarities are central to reading for understanding in each discipline.

Rosenblatt's Transactional Reading Theory

Louise Rosenblatt (2013) was a literary theorist whose theoretical model was influenced by a variety of academic views, including literary and social history, philosophy, aesthetics, linguistics, psychology, sociology, and anthropology (p. 923). As a reader-response theorist, Rosenblatt (1978, 1993) viewed reading as a sociocultural event that emphasizes the role of the individual reader as actively involved in constructing texts rather than passively consuming them. According to Rosenblatt (1993), when interacting with a text it is both a sociocultural and an individual event. Atkinson and Mitchell (2010) state, “Reader response theory conceptualizes readers’ responses to texts as co-constructing the meaning of the texts with the author, so that there is no single totalized meaning for readers to “get, excavate, or locate” (p. 9). Rosenblatt (2013) emphasized that the readers, as much as the text, play an active role in a reading experience.

Rosenblatt (2013) explained that reading is more than a one-sided transmission of ideas from the text to the reader, but a transaction. According to Rosenblatt (2013), reading is a two-way transactional process in which readers transact with texts, gain information from them, and then comprehend the text according to their background, experiences, and personal beliefs.

Rosenblatt (1982) defined the reading process by saying:

the transactional nature of language and the concepts of transaction and selective attention illuminate what happens in reading. Every reading act is an event, a transaction involving a particular reader and a particular configuration of marks on a page, and occurring at a particular time in a particular context. Meaning does not reside ready-made in the text or in the reader; it happens during the transaction between reader and text. (p. 159)

According to Rosenblatt (1982), the meaning of the text is derived from the symbols on the page and readers' experience and background knowledge, as well as the context in which readers read the text (Too, 2013). Rosenblatt's forerunner, Wolfgang Iser (1978), stated, "Literary texts initiate 'performances' of meaning rather than actually formulating meanings themselves" (p. 27). Reading events include readers and the context. Reading is a creative act that involves the readers' imagination and intellect. All readers bring their life experiences to the texts they read. When readers read a text—readers with their beliefs and the text with its features—they work to make meaning. Meaning-making is influenced by the context in which readers find themselves reading.

To understand what someone else knows about a subject or text, readers must activate their metalinguistic awareness. They create their meaning through a transaction with the text based on personal associations. Rosenblatt (1985) points out that during reading, both the reader and text are active, but in an organic, rather than a linear, mechanical way (p. 101). Reader response focuses on readers' experience and the way they respond. The response can be emotional or directly related to the text content. Reading is the transaction between authors and readers; the text is not set and absolute. The author may have a set meaning or meanings for the text, but because of the reader's intellect and background, no one meaning of the text can be guaranteed.

As readers interact with texts and comprehend what authors are communicating, they read with a purpose or stance. Rosenblatt (2013) explained, "the stance, the purpose, and the linguistic-experiential equipment of the reader, as well as the signs on the page, enter into the transaction and affect the extent to which public and private meanings and associations will be attended to" (p. 932). Rosenblatt (1988) maintains that the stances are "predominately efferent or

predominately aesthetic” (p. 5) and fall on to a continuum, and when readers read within this continuum, they can transact with the text.

At one end of the continuum is the efferent stance, which refers to students’ gathering of information needed after the reading. For example, when they read an article to discover when World War II occurred, they use an efferent stance. According to Rosenblatt (1988), in an efferent stance, readers’ attention is focused mainly on the “abstracting-out and analytic structuring of the ideas, information, directions, conclusions to be retained, used, or acted on after reading event” (p. 5).

At the other end of the continuum is the aesthetic stance, which refers to what learners experience as they read the text. Iser (1978) suggested that an aesthetic response is needed for the act of reading. Rosenblatt (1988) explained that the aesthetic stance refers to readers’ adoption of an attitude of readiness to focus attention on what they are living during the reading process. She described that a reader who takes an aesthetic stance “experiences, savours the qualities of the structured ideas, situations, scenes, personalities, and emotions called forth. Participating in the tensions, conflicts, and resolutions as they unfold” (p. 5).

For many readers, being able to connect with the text emotionally makes the reading easier to comprehend. This emotional connection includes the thoughts, opinions, ideas, feelings, and background knowledge that surface with the reading (Albright, 2002). When students read a story or a poem, Rosenblatt (1991) stated, they “assume that they are free to pay attention to what the words call to consciousness. They savour the images, the sounds, the smells, the actions, the associations, and the feelings that the words point to” (p. 447).

Most readers will situate themselves somewhere along the efferent and aesthetic continuum as they read. Rosenblatt (2013) explained that students who read for pleasure

(aesthetically) still need a certain amount of an efferent stance to understand the text. For example, when reading, students might read just because of the suspense and desire to know what happens to the protagonist, which is an aesthetic stance. To understand the protagonist's plight, students might need to keep track of the setting, character motivation, and aspects of the story to understand the theme of the story; this falls closer to the efferent stance on the continuum. Rosenblatt contended that most reading for pleasure falls somewhere in the middle of the continuum.

When students read nonfiction texts such as those in science and math classes, they often sacrifice the aesthetic for a purely efferent or information-gathering experience. Encouraging both aesthetic and efferent responses results in more successful engagement and richer comprehension of the nonfiction content that students learn (Carr et al., 2001). Even though most discipline-specific texts require that readers take an efferent stance as they read, it will be significant to discover whether participants in this research will be aware when they move from an efferent to an aesthetic stance as they read, and how that impacts their comprehension and teaching.

Literature Review

The purpose of this review is to investigate some of the research literature as it pertains to my study. After I surveyed the literature, I sorted the areas of discussion into the following categories: (a) literacy evolving; (b) perspectives on reading; (c) disciplinary literacy; (d) situated language; (e) importance of culturally and linguistically diverse students; (f) current research on secondary discipline specialists and discipline-specific literacy; (g) reading in the disciplines; (h) teachers' content knowledge; (i) metacognition; (j) think aloud; and (k)

categorization of literacy practices. I begin this discussion with an explanation of the changes in literacy.

Literacy Evolving

Literacy is a difficult concept to define; it changes over time, and thus has a variety of definitions. The description can be simple, such as Frey and Fisher's (2004) definition, which is the ability to read, write, speak, listen, and view. Slater (2004) expanded the definition and called it high literacy, which is "the educational goal of teaching all students to think, read, and write critically" (p. 40). Alberta Education (2016) defined a more complex literacy: "*the ability, confidence and willingness to engage with language to acquire, construct and communicate meaning in all aspects of daily living*. Language is explained as a socially and culturally constructed system of communication" (para. 1). For this study, I will use the Frankel et al. (2016) comprehensive, five-component description of literacy as provided earlier on page 8.

For many years, literacy has been considered reading, writing, viewing, representing, speaking, and listening to traditional texts. These texts include paper copies of literature, articles, journals, newspapers, the visuals of movies in theatres, DVDs, and other forms, and audio given through radio, television, and CDs. Literacy has evolved significantly in the past several decades to include a greater variety of texts and means of understanding those texts. In his forward to *Reading the Visual* (Serafini, 2014), Gee explains the world is multimodal, and that to communicate we use multimodalities. Gee explains further, "Language is one mode; images, actions, sounds, and physical manipulation are other modes" (Serafini, 2014, p. xi). According to Kress (2010), to communicate and make meaning, literacy involves multiple modes including auditory, spatial, behavioural, and visual modes.

All language is *multimodal*. Kalantzis, Cope, Chan, and Dalley-Trim (2016) define multimodality as “using more than one mode in a text or a meaning-making event” (p. 229). Kalantzis et al. (2016) explain that meaning making is becoming more multimodal, occurring when written text interfaces with “oral, visual, audio, gestural, tactile and spatial patterns of meaning” (p. 2). Multimodal texts include comics/graphic novels, picture books, newspapers, brochures, print advertisements, posters, storyboards, digital slide presentations (e.g. PowerPoint), e-posters, e-books, and social media. Jones, Turney, Georgiou and Nielsen (2020) point out that in our increasing digital communication age, 21st century learners require the ability to both understand and use multimodal literacies. Kalantzis et al. (2016) emphasize the need to “extend the range of literacy pedagogy beyond alphabetical communication” (p.2). Traditional reading and writing instruction needs to be complemented with multimodal communication with an emphasis on digital media.

Transliteracy and New Literacies demonstrate the evolution of literacy. Transliteracy takes into consideration the various abilities and modes involved in literacy, and Thomas et al. (2007) defined it as “the ability to read, write and interact across a range of platforms, tools and media from signing and orality to handwriting, print, TV, radio and film, to digital networks” (p. 2). Frau-Meigs (2017) gives transliteracy a double definition. The first is “the ability to embrace the full layout of multimedia which encompasses skills for reading, writing and calculating with all the available tools (from paper to image, from book to wiki)” (p. 15). The second component entails “the capacity to navigate through multiple domains, which entails the ability to search, evaluate, test, validate and modify information according to its relevant contexts of use (as code, news and document)” (p. 16).

New Literacies incorporates a wide-ranging understanding of literacy. It is a mainly sociocultural view of literacy (New London Group, 1996; Gee, 2005) that encompasses a combination of discourses (Gee, 2014), semiotic contexts (Bezemer & Kress, 2008), and the proficiencies of multiple literacies (Leu et al., 2013). Spires and Kerkhoff (2016) explain that “semiotic contexts focuses primarily on the symbols and the emerging new media used to convey meaning” (p. 283). The proficiencies of multiple literacies refers to what Leu et al. (2013) refer to as new skills, strategies, and depositions needed for online research and comprehension. Coiro et al. (2014) define New Literacies as practices made obtainable through the introduction of new and multi-media, mainly (though not entirely) relating to digital innovations. Examples of such digital innovations include blogs, fan fiction, video games, websites, and online social networking. According to Spires and Kerkhoff (2016), users of New Literacies require the abilities to recognize a research question or a problem, discover trustworthy sources both offline and online, read using an analytical lens, create understanding by amalgamating information from numerous sources, and communicate utilizing suitable modes (p. 283). Whatever means of literacy is being used, reading is often an important part in its understanding.

Perspectives on Reading

Being able to read and construct meaning from text is a complex and important ability that occurs in a sociocultural context. According to many scholars, including Ruddell and Unrau (2013) and Huey (1968), reading is one of the mysterious skills that humans have. Huey (1968) called reading the “most remarkable specific performance that civilization has learned in all its history” (p. 6). Alvermann and Moje (2013) stated that “reading is among the most complex of human processes, situated in myriad human practices. No simple, linear model will explain it, and no simple, linear model successfully guide its teaching” (p. 1099).

Many definitions of reading exist, and a few will be provided here. Reading is something we do with language, which Marie Clay (2001), a distinguished global educational literacy researcher, defined as:

a message-getting, problem-solving activity, which increases in power and flexibility the more it is practiced. It is complex because within the directional constraints of written language, verbal and perceptual behaviours are purposefully directed in some integrated way to the problem of extracting sequences of information from texts to yield meaningful and specific communications. (p. 1)

Shepherd and van de Sande (2014) describe reading as “an active process of meaning-making in which knowledge of language and the world are used to construct and negotiate interpretations of texts” (p. 75). Goodman (1988, 1996) explains that reading is a part of a receptive language process. Goodman (1996) describes reading as a psycholinguistic guessing game through which the reader thinks, using the tools and processes the reader possesses. Language is a system of symbols—a semiotic system. Goodman elucidates that language is a system of symbols. It not only designates things, activities, and experiences, but also embodies the way these relate in all the intricacies of human experiences with other people and the world.

Language is productive and receptive. When examining written language, Goodman describes the act of writing as the productive component and reading as the receptive component. For most readers (except for the visually impaired), reading is used through vision to comprehend written language, which Goodman (1996) describes as graphic shapes on flat surfaces. According to Goodman (1988), there is an “essential interaction between language and thought in reading” (p. 12).

Abraham (2002) explains two theoretical models of reading—bottom-up and top-down. The bottom-up model refers to “the ability to decode or put into sound what is seen in a text” (p. 1). The reader learns from decoding and obtaining information coming only from the text. The top-down model focusses on “what the readers bring to the [reading] process” (p. 1). The reader brings to the experience the background knowledge that is needed to understand the text. An amalgamation of the two models also exists, which Abraham (2002) calls the interactive approach. This model emphasizes “both what is on the written page and what a reader brings to it using both top-down and bottom-up skills” (p. 6).

Throughout the reading process, a person is making sense, constructing meaning, or comprehending, using the symbols on the page as well as the background knowledge and experience that the reader brings to the text. Goodman’s explanation of reading demonstrates an interactive approach. According to Goodman (1996), “The sense you make of a text does not depend first of all on the marks on the paper. It depends first on the sense you bring to it” (p. 1). This sense, including individual experiences, is a reason why no two readers produce the exact same meaning of a text, and not necessarily the exact same meaning as the author intended.

Successful readers read both effectively and efficiently. As long as a reader gets to the meaning they are effective. An efficient reader gets to the text meaning the quickest way possible. Goodman (1996) notes, a successful reader needs to use various reading approaches and strategies:

As readers use cues from linguistic texts, they bring their knowledge and beliefs about the world to bear on making sense. They ‘guess’ what’s coming, making predictions and inferences; they are selective about use of text cues and they monitor their ‘guesses’ for contradictory cues. Effective reading, then, is not accurate word recognition; it is getting

to meaning. And efficient reading is using just enough of the available cues, given what a reader brings to the reading, to make sense of the text. (pp. 7–8)

Reading skills and strategies come in various forms.

Purposes and functions of reading are also aspects of reading. Purposes for reading are specific and more personal, whereas; functions of reading are more general and more likely shared with the culture or society. A purpose for reading can be looking at the label of a pill bottle to determine how often a person needs to take a medication and how many to take. Selecting specific information, such as getting a baseball player’s playing statistics, being amused by a cartoon, or knowing what ingredients go into a favourite recipe are all examples of purposes for reading.

When communicating, the speaker, reader, listener, and/or writer need to consider the purpose of the communication, the audience they are addressing or to which they are referring, and the form in which they are going to communicate. Goodman (1996) explains that language is simpler to learn when it is functional. According to Halliday (1985), the routine use of language is called “goods and services” functions. Goodman (1996) puts it this way, “The *form* language takes depends on the *functions* it serves and the situations in which it occurs” (p. 21). Goodman (1996) utilizing Halliday’s (1985) notion of genre defines it as “[genre] whether written or oral or both, is a language form that develops within recurring social-cultural situations to meet the constraints of the speech acts or literacy events that commonly occur in those contexts” (p. 21).

A genre can take many forms, including telephone conversations, e-mails, websites, friendly or business letters, science labs, math problems, essays, short stories, cartoons, movies, or a plethora of advertisements. Goodman breaks down the genre into three parts—the field, the tenor, and the mode. The field refers to the context—the what, why, where, and how—of the

communication. The relationship between the participants, which considers the role of the audience, is the tenor. Mode is the choice of language, such as the font size, layout, and structure of the communication.

Goodman (1996) maintains that each genre has its own field, tenor, and mode, and within an authentic literacy event, the language text that is created is also authentic:

only within a situational context and a genre. ... as readers, we have a function and a purpose for reading. It means that we bring to the reading past experience with the field of the text and with the mode in this context, and the tenor between writer and reader is one that makes communication possible. (p 27)

In order for us to make sense of what we read, Goodman elucidates that we need to be cognizant of the context in which the text has been written—where, when, by whom—and why the author has chosen the mode.

Along with having purposes and functions and understanding genre, a reader needs to be motivated to read and to engage with the text. Frankel et al. (2016) explain that the motivation or the reader's reason for reading and the reading itself are interconnected and reciprocal. They state that "motivation for reading increases a reader's breadth and depth of reading and comprehension and in turn, contributes to increased motivation" (p. 12). The more motivated the reader is, the more they will read and engage successfully with the text. According to Hall (2010, 2016), this motivation is connected to reader identity and whether a reader views themselves as a good or weak reader.

According to Prior and Welling (2001), advanced readers—including most teachers—tend to read silently rather than orally. Adults tend to consider reading a private activity in which they move language from a social world into a private world—i.e., private speech (Vygotsky,

2012). Private speech, according to Auleear Owodally (2021), is “speech-for-the self, dialogue with oneself, a type of intrapersonal speech that is externalized or vocalized or written down” (p. 18). It is often used as a self-monitoring strategy (Lantolf, et al., 2015). When reading a difficult text, child or adult readers may also use what Kragler (1995) and Gilliam et al. (2011) call mumble reading (reading out loud what sounds incoherent, for self only). Prior and Welling (2001) explain that the use of mumble reading is a means of self-monitoring. Trainin et al. (2015) point out that readers who use oral language can achieve higher comprehension.

For whatever purpose, function, or motivation that a text is being read, Goodman (1996) explains that reading can be done using both alphabetic and non-alphabetic texts. People read using non-alphabetic writing systems such as those found in math and science texts. Numerals and symbols are ideographs and are used to communicate information. The use of these math and science ideographs makes the information legible by speakers of most languages and thus make them a universal language. Many math and science symbols and equations use numerals, symbols, and letters from the alphabet. No matter what is being read, whether it is written using alphabetic or non-alphabetic symbols, it is helpful to know how to read discipline-specific texts using discipline-specific literacy.

Disciplinary Literacy

Disciplinary literacy is foundational to my research. In this section, which describes disciplinary literacy and its various components, I explain: (a) the disciplines; (b) the increasing specialization of literacy development; (c) the difference between content-based and disciplinary literacy; (d) teachers as discipline specialists; (e) the three roots of disciplinary literacy; (f) disciplinary-literacy foci; and (g) disciplinary-literacy significance.

Disciplines. According to Turner (2000) and Pinar et al. (2008), modern disciplines in relation to curriculum and subjects taught in schools have evolved throughout the 20th and 21st centuries. Initially, the disciplines found within school curricula originate from academic disciplines. Turner (2000) describes these disciplines as:

collectivities that include large proportion of degree holding individuals with the same differentiating specialization name, which are organized in part into degree-granting units that in part give degree-granting positions and powers to persons holding these degrees; persons holding degrees of this particular specialized kind are employed in positions that give degree-granting powers to them, such that there is an actual exchange of students between different degree-granting institutions offering degrees in what is understood to be the same specialization. (p. 47)

Schwab (1974), Turner (2000), and other scholars agree that defining disciplines is complicated.

Schwab (1974) maintains that disciplines are important to education. Educators consider disciplines as they “plan curriculum and prepare teaching materials” (p. 163). Schwab (1974) supports that without the disciplines, educators’ best laid educational plans could lead to misteaching or to the teaching of inaccurate information. The government or teacher-developed curriculum relies on the disciplines to inform the most accurate information.

Tomlinson (in Lent, 2016, p. xiv) explains that the disciplines were made to help resolve the age-old questions, “What is life, and who am I in it?” History, mathematics, literature, and the sciences, each in its way, were made to aid in answering that question. Disciplines are social constructs (Moje, 2015) created by humans. Each discipline has its linguistic challenges and literacy requirements. Beauchamp and Thomas (2009) maintain that disciplines tend to have their own teaching cultures. Recently there has been an emphasis by some scholars (Maldonado-

Torres, 2019; Ali et al., 2019; Parsa, 2012; Rao, 2012; Shihade, 2017) for the need to decolonize the disciplines in higher education. According to Shahjahan, Estera, Surla, and Edwards (2021) the reason for this push to decolonize is because “Curriculum and pedagogy is deeply implicated in grounding, validating, and/or marginalizing systems of knowledge production” (p. 74). If higher education disciplines are decolonized, the disciplines taught within school subject areas will most likely be changed.

Moje et al. (2010) refer to disciplines when investigating the work of researchers and professionals who participate in disciplinary study. They refer to subject-matter areas when exploring how students and teachers think about school texts. Moje et al. (2010) explain that the above distinctions and their “rationale for looking at the relationship between the two, rest on the idea that the nature of a discipline contributes to how subject-areas are framed in schools and to what occurs in classroom teaching and learning” (p. 454). Spires et al. (2018) point out that in the milieu of secondary school each discipline is comprised of subdisciplines. For this research, the disciplines will refer to science (biology, chemistry, and physics), SS, ELA, and math.

Increasing Specialization of Literacy Development. Before describing disciplinary literacy specifically, I provide a quick explanation of what seminal disciplinary literacy researchers Shanahan and Shanahan (2008) and other scholars (Faggella-Luby et al., 2012; Paul, 2018; Tang, 2016) call the “increasing specialization of literacy development” (p. 44). This description gives some background on literacy development. Literacy use and understanding progresses from basic literacy to intermediate literacy and, finally, to disciplinary literacy. Shanahan and Shanahan (2008) refer to basic literacy as “literacy skills like decoding and the knowledge of high frequency words that underlie virtually all reading tasks” (p. 44). They explain that intermediate literacy refers to “literacy skills that are common to many tasks,

including generic strategies, common word meanings, and basic literacy” (p. 44). Content literacy would fall within the intermediate literacy category. Disciplinary literacy, Shanahan and Shanahan (2008) explain, is literacy skills “specialized to the various disciplines, such as history, the sciences, mathematics, and literature” (p. 44). McCarty and Degener (2018) determine that “disciplinary literacy involves employing the specialized practices that experts use to read and write disciplinary text” (p. 5). In understanding my research, it is helpful to recognize the difference between content-based and disciplinary literacy.

Differences Between Content-Based and Disciplinary Literacy. Learning content-based literacy involves teaching generic literacy practices within all subjects or content areas. These practices are skills that students generally need in order to understand texts; they include summarizing, note-taking, concept mapping, inferring, sequencing, predicting, comparing and contrasting, and reading and writing text (Fang & Coatoam, 2013). Content-based literacy instruction promotes the ability to interact with content or subject texts using various similar generic literacy practices in all subject or content areas (Johnston et al., 2016; Marlatt, 2018). This instruction does not take into consideration the particular subject- or content-specific nuances or reading needs, but helps struggling readers become aware of the literacy practices that more competent readers use expertly (Shanahan & Shanahan, 2012).

Frankel et al. (2016) explain that purposefully teaching discipline-specific reading strategies “is more effective than teaching decontextualized reading strategies in isolation, which risks framing a strategy itself as the end goal, rather than focusing on the learning goals that the strategy is meant to aid” (p. 11).

Content-based literacy assists students who tend to struggle with reading in general, whereas disciplinary-literacy focuses on literacy practices that assist students to read and think as

discipline specialists. Important differences exist between content-based literacy and disciplinary literacy, but I concur with Spires, Kerkhoff, and Paul (2019), that content and disciplinary literacy can be complementary practices (p. 12). They can be complementary, but as Howell et al. (2021) point out, “Even though disciplinary literacy builds upon the skills of content area literacy, success with the latter does not guarantee the former” (p. 3). Di Domenico et al. (2018) make the point that teachers are not expected to “choose between longstanding content area literacy strategies or taking a disciplinary literacy approach to instruction. Content area literacy strategies can serve as important scaffolds for disciplinary habits of reading, writing, talking, and thinking” (p. 83). Faggella-Luby et al. (2012) emphasize that a disciplinary literacy framework’s key feature “is the assumption of prerequisite foundational reading and writing skills. ... students must be able to use general comprehension strategies effectively to comprehend and compose grade-level text before advancing those strategies within discipline-specific approaches and texts” (p. 71). Faggella-Luby et al. (2012) are concerned that there are students who lack the essential foundation.

Fang (2012b) points out the goal of disciplinary literacy is to help students to grow in content-area thinking that is consistent with discipline specialists by developing their “ability to engage in social, semiotic, and cognitive practices” (p. 19) that are content or subject-specific. Brozo et al.(2013) explain, “Disciplinary literacy approaches are based on fundamentally different assumptions. Unlike the outside-in approach of content area reading, disciplinary literacy evolves from the inside out because the text itself and the goals for reading the text dictate the reading processes” (p. 354). Wiesner et al. (2020) point out that disciplinary literacy draws “attention to the ways in which participants draw on discipline-specific tools to operate ..., including the ways in which specialized norms of communication are enacted ... (p. 209).

According to Shanahan and Shanahan (2012), “Disciplinary literacy emphasizes the unique tools of the experts and discipline used to engage the work of that discipline” (p. 8). Table 1 contains a summary of Shanahan and Shanahan’s (2012) explanation of content-based and disciplinary literacy.

Table 1

Content-Based and Disciplinary Literacy Defined

Content-based literacy	Disciplinary literacy
Equips learners with generic tools (a collection of reading strategies and study skills) to make them proficient navigators of texts across all disciplines (pp. 9, 12).	Transforms learners into disciplinary insiders able to approach tasks with some sense of agency and response patterns that characterize the disciplines (p.11).
Helps learners acquire the skills to mine information from texts (p. 8).	Sensitizes learners to the unique properties of disciplines (p. 12).
Poses the challenge of “stretching” of strategies (of not only learning generic tools but recognizing the suitability or efficacy of the tools to use in any given discipline) (p. 15).	Uses tools in the disciplines that have organic roots. No strategy stretching is needed (p. 15).

According to Moje et al. (2004), disciplinary literacy includes discipline knowledge, literacy skills, and discursive skills. Literacy skills comprise encoding, decoding, comprehension, interpretation, and persuasion (p. 46). Knowledge of the discipline consists of concepts, word definitions in various contexts, information, and procedures (p. 46). Discursive skills include ways of making, using, and communicating knowledge, such as explaining, offering empirical evidence, offering personal experience, predicting, and classifying (p. 46). Moje et al. (2004) explain that it is insufficient to have discipline-specific knowledge alone.

They maintain that a discipline-specific text reader is required “to have an awareness of how knowledges are created and structured in the discipline, an understanding of what counts as warrant or evidence for a claim, and an understanding of the conventions of communicating that knowledge” (p. 45). Moje (2013) compares disciplines to school subject areas because subject areas are how the disciplines are experienced in school. Lee et al. (2021) emphasize that the “shift toward DL [disciplinary literacy] requires content area teachers to thoroughly know disciplinary content, effective general pedagogy, and how to teach literacy skills and practices” (p. 220).

Teachers as Discipline Specialists. The concept of teachers as discipline specialists in each core subject (discipline)—math, science (chemistry, physics, or biology), ELA, or SS—in Alberta secondary schools is more complicated than it might appear. According to Frankel et al. (2016), “literacy processes vary across disciplinary contexts and are formed by the epistemologies, inquiry practices, conceptual frameworks, text, and language structures of particular disciplines” (pp. 7–8). In each subject, a teacher needs to understand several subdisciplines (Spires et al., 2018). For ELA, some of the specific subdiscipline understandings that teachers require include: classical and modern literature; linguistics; narrative, informative, persuasive, and descriptive writing; and reading and writing strategies. Some of the understandings that math teachers need are algebra, trigonometry, and geometry. In junior high science, teachers must be versed in biology, chemistry, and physics, which they teach as one subject. In high school, teachers either teach science as science, or it is split into three distinct disciplines—biology, chemistry, and physics—each of which has specific subdisciplines. SS teachers need to understand the disciplines of history, geography, sociology, political science, and economics.

Secondary school discipline experts use many of the same literacy practices as in content-based literacy, but they use the practices differently within disciplines because they use different academic language and view texts with a specialist's eye (Lee et al., 2021; Croce & McCormick, 2020; Malmström & Pecorari, 2021; Fang, , 2012b). Marlatt (2018) points out that certain disciplines, such as social studies and English language arts, are more literacy-based than other subjects such as mathematics and the sciences. Shanahan and Shanahan (2012) stated that “a disciplinary literacy approach emphasizes the specialized knowledge and abilities possessed by those who create, communicate, and use knowledge within each of the disciplines” (p. 7). Wickins et al. (2015) maintain that the teaching of disciplinary literacy should focus not only on students' abilities to think like scientists, historians, mathematicians, or creators of ideas, but to think scientifically, historically, mathematically, or creatively (p. 79). For this study, I define disciplinary literacy as the specific literacy practices required within each core subject areas—science, SS, ELA, and math—taking into consideration the complexity of each subject area.

Teachers need to be able to teach students discipline-specific knowledge as well as how to interact with discipline-specific texts. According to Fang (2014), “Being literate in a discipline means not only knowledge of disciplinary content but also the ability to read, write, think, and reason with texts in discipline-specific ways” (p. 446). Cisco (2016) discovered that discipline specialists did not necessarily reflect a disciplinary perspective; they tended to adopt a singular stance that was used regardless of text. Discipline specialists, Cisco explains, required the capability to link their current stances to applicable disciplinary lenses (p. 15). The generic literacy strategies that content-literacy proponents encourage teachers to use generally do not take into consideration the discipline-specific nuances of the content area. Shanahan and

Shanahan (2012) give an excellent synopsis of the discipline-specific literacy that teachers need in order to teach in content areas:

Disciplines differ extensively in the fundamental purposes, specialized genres, symbolic artifacts, conditions of communication, evaluation standards of quality and precision, and use of language. With regard to language use, different purposes presuppose differences in how individuals in the disciplines structure their discourses, invent and appropriate vocabulary, and make grammatical choices. (p. 9)

The teaching of disciplinary literacy takes specific skills that are conducive to each specific discipline.

The Three Roots of Disciplinary Literacy. The three roots of disciplinary literacy are the historical development of content-area reading, cognitive analyses of expert readers, and functional linguistics (Shanahan & Shanahan, 2012, p. 12; Moore et al., 1983). The first root, content-area reading, can be traced to the early 1920s with an instructional application of reading to content subjects. Teachers taught content reading by using generic reading strategies—the comprehension of terminology in textbooks, the obtainability and usefulness of various instructional procedures, and connections among comprehension measures based on general and subject-specific texts—in all subjects. Shanahan and Shanahan (2012) maintain that content area reading “has pointed toward a theoretical conception of literacy processes specialized to particular disciplines while fostering a fundamentally different approach, based upon highly generalizable learning strategies or processes that could be easily adapted and used across different school subjects” (p. 13).

Shanahan and Shanahan (2012) explain that the second root of disciplinary literacy is expert reader studies in which researchers have explored the reading of science, history, and

poetry using think aloud and observations. According to Shanahan, Shanahan, and Misischia (2011) and Shanahan and Shanahan (2012), by using observations and think-aloud protocols, discipline experts perform a literacy practice such as reading texts while they think aloud. These studies identified “strategies, perspectives, choices, and tendencies used by experts that involved a sense of self-awareness” (p. 13). For example, studies of physicists reading revealed that they paid close attention to unfamiliar information and material that went against their expectations. Historians, on the other hand, tended to pay attention to the authors (sourcing), connect texts to the circumstances of the time (contextualizing), and make comparisons across texts (corroboration; p. 13). Nonexperts, such as students, read the same texts while they think aloud. By observing them, researchers can determine the skills of both expert and novice readers.

Shanahan and Shanahan (2012) describe the third root of disciplinary literacy, functional linguistics (Fang, 2012c). It focused on grammar by considering the context and practical usages of the language, which makes it valuable for consideration of variances across disciplines. For example, researchers have used functional linguistics to analyze science and history discourses. Science texts tend to involve nominalization (Fang, 2012c; McArthur, 2012) (the use of a word that is not usually a noun, such as a verb, adverb, or adjective, as a noun), whereas, history texts interpret events and actions, conceptual and oral methods, descriptions, and background information rather than word classifications. The verbs in history texts carry much more of the meaning than they do in science texts. With the three roots of disciplinary literacy established, I now present a description of disciplinary-literacy foci.

Disciplinary-Literacy Foci. According to Shanahan and Shanahan (2012), disciplinary literacy is characterized by specific foci which include understanding discipline-specific vocabulary, recognizing the different views that discipline experts have of text authors, and

realizing that discipline experts think about and navigate through texts in specific ways.

Shanahan and Shanahan point out that vocabulary instruction is one of the key content-literacy practices that teachers often teach generically (p. 9). Teacher-education textbooks written for content reading present study skills that they are expected to use to teach vocabulary skills in any subject area. These include making connections among concepts and constructing graphic organizers, which do not adequately help students with the specific nuances of the vocabulary they learn within the different disciplines.

Students need different skills to learn science and history terminology than to learn vocabulary in other disciplines (McArthur, 2012). Much science vocabulary, for example, originates from Latin and Greek and, therefore, contains the roots, prefixes, and suffixes of those languages. Students who understand Greek and Latin derivatives are better able to comprehend science concepts and the vernacular. Paugh and Wendell (2021) explain “scientific discourses challenge users to develop facility with language that is dense and abstract, and that draws on specialized verb types, complex noun groups, and nominalized verbs” (p. 125). Shanahan and Shanahan (2012) stated, “The nature of scientific vocabulary and the specialized tools to construct and analyze vocabulary used within the sciences are the forte of disciplinary literacy” (p. 9). Paugh and Wendell (2021) also point out that scientific language requires the reader to focus more on conceptual categories rather than on concrete experience in a specific time and place. Scientific discourse is less personal and more factual; it also adds authority and objectivity. In contrast, the language of history does not involve the technicalities of science language. However, students must deeply understand events or actions in history and their relation to each other in order to understand comparisons or allusions to different historical times.

Disciplinary-literacy instruction focuses on how disciplinary experts think about authors during readings (Shanahan & Shanahan, 2012). It is, therefore, essential that learners in the different disciplines understand how experts view or think about the authors of the content they read. When they read, historians are cognizant of writers' sources and biases and "the implications of the author during interpretation" (p. 11). In the sciences, experts view authors in the opposite way that historians view authors. Scientists try to focus on the texts themselves rather than on the authors. Mathematicians contend that thinking about authors does not help them focus on and understand the text. To read literature, some theorists recommend a close reading of the texts, whereas others would advise readers to consider the authors and their backgrounds and ideas. In summarizing the importance of reader viewpoints of authors Shanahan and Shanahan (2012) note that:

students must always read history with an eye to the author, while never reading mathematics that way. Students should reflect the authorship sparingly in science reading, though never to make sense of the text. When reading literature, they should sometimes interpret the author along with the text and, at times, focus on the words of the literature with no consideration of the author at all. (p. 11)

The goal of disciplinary literacy is to transform students in particular disciplines into discipline scholars. Fang and Coatoam (2013) concur, stating that disciplinary literacy "recognizes that literacy skills/strategies and disciplinary content are inextricably intertwined and that without literate practices, the social and cognitive practices that make disciplines and their advancement possible cannot be engaged" (p. 628).

According to Shanahan and Shanahan (2012), discipline experts navigate through and think about the texts they read in distinct ways. By examining primary and secondary documents

and sources, historians study historical events. Scientists, on the other hand according to Shanahan and Shanahan, evaluate and particularly test investigational and observational proof and reason. Mathematicians understand their texts by concentrating on the effects of a set of axioms or self-evident truths. According to Shanahan and Shanahan, experts in literature “explore fictional or imaginal representations of human relations or development” (p. 12) to understand their texts. Spires et al. (2018) explain that literature experts analyze literal content, such as plot, setting, and characters; analyze the inferential, such as figurative language, structure, and narration; and analyze the interpretative, including literacy theory and personal responses (p. 1407).

Shanahan and Shanahan (2012) also explain that scientists are careful about drawing conclusions from texts because they need to reproduce final products in similar circumstances, using similar variables. Science texts often include mathematical equations, graphics, diagrams, charts, tables, and prose to show the information that researchers have gathered from their studies (Spires et al., 2018). According to Fang (2014), science texts have a high degree of lexical density. Shanahan and Shanahan (2008) explain, “*Lexical density* is marked by the number of content words embedded in clauses, by the total number of content words, or through the percentage of content words in relation to the total number of words” (p. 53). Spires et al. (2018) add that scientists are required to synthesize information presented in multiple forms as well as synthesize information across texts.

Shanahan and Shanahan (2008) explain that historians often collect information from partial texts after an event has occurred. Their conclusions are plausible, but not precise; they do not have to carry the same precision as science texts should. Therefore, historians have different restrictions than scientists do when each of them examines evidence and standards. As textbooks

and other teaching tools are created, differences in functional linguistics need to be taken into consideration. According to Spires et al. (2018), historians also understand historical significance, historical causation, as well as can recognize the difference between fact and speculation (p. 1409).

According to Shepherd and van de Sande (2014), more research needs to be done that explores how readers engage with math texts, especially the exposition portions. Shepherd and van de Sande's (2014) investigation demonstrated that their participants used three dimensions that contribute to successful comprehension of mathematical exposition: mathematical fluency, comprehension monitoring, and engagement (p. 77). Mathematical fluency, as Shepherd and van de Sande (2014) point out, refers to how readers articulate words and symbols. Readers require the ability to automatically translate written text into understandable ideas by decoding mathematical symbols and understanding vocabulary. Skimming is used effectively when reading familiar information.

Shepherd and van de Sande (2014) explain that comprehension monitoring refers to reader self-monitoring awareness—how cognizant readers of their own understanding and how they manage confusion while reading. Successful readers used comprehension checks when needed to remedy loss of comprehension. To be aware of their ongoing comprehension, the readers required perseverance and the willingness to repair their understanding loss. Engagement described by Shepherd and van de Sande (2014) are the ways that readers examine the passage content and “search beyond the actual passage in order to more fully understand the material” (p. 77). Readers will access the diagrams provided by authors to assist comprehension. These readers also were willing to search “external sources to refresh and review their understanding of unfamiliar or forgotten concepts” (p. 83).

While Shanahan and Shanahan (2008, 2012) and Shepherd and van de Sande (2014) focus on university level discipline-specific reading engagement, concentrating on secondary teacher disciplinary text engagement is important and will assist with student discipline literacy success. My research questions are intended to address teachers' abilities to understand their disciplinary text engagement. Fang (2012) points out:

Being literate in a discipline means both deep knowledge of disciplinary content and keen understanding of disciplinary ways of making meaning ... and its development involves simultaneous engagement with disciplinary content (e.g., core concepts, big ideas, key relationships) and disciplinary habits of mind (e.g., reading–writing, viewing–representing, listening–speaking, thinking–reasoning, and problem-solving practices consistent with those of content experts). (p. 20)

This leads to the importance of disciplinary literacy.

Disciplinary-Literacy Significance. The significance of disciplinary literacy should not be underestimated. Shanahan and Shanahan (2012) describe research that studied the effectiveness of teaching disciplinary literacy. De La Paz and Felton (2010) examined reading and writing from numerous historical source documents, looking for the effects of strategy instruction with low to average high school writers. Hynd et al. (2004) researched the thinking of a historian and explored college students' reading of multiple historical documents. The third study to which Shanahan and Shanahan referred is Nokes, Dole, and Hacker's (2007) research on teaching high school students to use heuristics while they read historical texts.

Even though the number of studies is limited, teaching disciplinary literacy is promising for several reasons. Shanahan and Shanahan (2012) maintain that disciplinary literacy is appealing to content or discipline specialists, who understand that “the insight and strategies of

disciplinary literacy are drawn from the disciplines themselves; a focus on this information does not pose the same challenges to teachers whose self-actualization is tied to their identities as math, science, English, or history educators” (p. 15). If teachers use authentic literacy practices, including learning strategies to help students learn within their specialties, the students are more likely to use them. Kalantzis et al. (2016) emphasize including multiliteracies to effectively teach discipline-specific literacy. For example, students learning science should be doing science like being given the opportunity to grow and harvest plants. Students experientially learn about science academic vocabulary.

Some teachers find it challenging to make a generalizable strategy fit within disciplines, so they are more likely to use a discipline-specific literacy strategy in teaching, which might help them in their practice, decreasing the resistance to teaching literacy practices within the content areas (Brozo et al., 2013; Hinchman & O’ Brien, 2019). Ippolito et al. (2019) emphasize that disciplinary literacy is the deliberate “apprenticeship of students into specialized ways of writing, reading, thinking, and communicating associated with both academic disciplines and their related professions” (p. 11). When they teach the students disciplinary literacy, teachers need to consider the intricate process in which both teachers and students must engage for the content to be taught and understood successfully. My research questions support the exploration of the intricate processes that occur while teachers read texts.

Students also need to acquire and use specific disciplinary-literacy skills. Secondary school students must be able to think, read, write, and navigate through texts as scientists, mathematicians, historians, and English specialists. Learners need to understand new vocabulary, how to summarize texts, and how to infer information from what they are learning. These literacy practices often require specific instruction in the specific discipline. Teachers must

“move beyond generalist notions of content area literacy” (Johnson et al., 2011, p. 107). Jewett (2013) drew a fitting conclusion regarding teaching literacy across subject areas: “All teachers need to recognize the role that languages and literacies play in disciplinary learning ... that fluency in disciplinary languages and texts would support learning in their content areas” (p. 23). McArthur (2012) recognizes the various challenges of engaging with discipline-specific texts, such as each discipline’s reading complexities, including text structure and organization, technical vocabulary use including nominalization, and the lexical density. Teachers and students must be aware of the various discourses they need, in order to understand and interact with the discipline-specific texts.

Students learn about a specific discipline or subject area within a specific social context (Moje et al., 2000), which includes the classroom, subject, students’ subject background, students’ peers, and teachers’ style. Within this social context is a discipline-specific Discourse or language that teachers must know and understand to be able to teach the language to learners. Gee (2014) defined a Discourse as an abstract way of communicating within a specific situation, including the integration of “words, deeds, values, beliefs, symbols, tools, objects, times, and places” (p. 53). Students must be fluent in the discipline-specific Discourse in order to create their discipline-specific identities (Gee, 2014; Moje, 2008), understand and communicate what they learn within each discipline, and recognize when they can extrapolate the knowledge and skills, they learn in one discipline to others. Gee referred to transferring information or language to another context of learning as *intertextuality*. My research questions allow for the exploration of the Discourses secondary teachers use to describe their discipline-specific texts.

Discipline-specific teachers need to be very clear about the writing, speaking, listening, and reading Discourses that are required within their subject areas. Gee (2014) described the

specialist language that discipline teachers use as *nonvernacular social language* (p. 23). Understanding their individual content-area identities enables teachers to teach the curriculum. For example, science teachers who are experts in their subject will speak, write, read, and listen in a specific manner to communicate with and teach students. These students need to be able not only to listen to and read the specific science content, but also to speak and write using the information they have learned. With years of immersion and education, teacher experts in math, ELA, science, or SS should be well versed in the techniques, vocabulary, and methods they require to create learning environments in which students become immersed in the subject area (Meyer et al., 2012). According to Wiesner et al. (2020), “Disciplinary literacy frames a reader’s engagement in terms of the ways of talking, reading, and representing in the discipline” (p. 207). It is helpful for readers of discipline-specific texts to be aware that the language used depends on the context in which it is employed.

Situated Language

Gee (2013) points out that we do not learn or use language within a vacuum; language occurs in a place, situation, and action:

Meaning in language is not some abstract propositional representation that resembles a verbal language. Rather, meaning in language is tied to people’s experiences of situated action in the material and social world. Furthermore, these experiences (perceptions, feelings, actions, interactions) are stored in the mind or brain, not in terms of propositions or language but in something like dynamic images tied to perception both of the world and of our own bodies, internal states, and feelings. (p. 136)

Gee (2013) notes that the awareness of the context in which we use and learn language is important to comprehension. Words, deeds, and things make up not only our context, but also

our purposes, values, and intended courses of action and interaction (p. 138). Language learners can make better connections to what they are learning if they are cognizant of the context.

The following is a summary of Gee's (2004) argument about situated language that apply to my research (pp. 3–5). The first is that learning to read and write within content- or academic-specific subjects—math, science, SS, and ELA—is very difficult. Second, Gee maintained that for students to be successful in these subjects, they must understand the subject-specific varieties of academic language as well as other subject-specific symbolic systems such as: algebraic equations; mathematical formulas in math, chemistry, and physics; and English-specific literature-analysis texts, to name a few. Third, Gee contended that the thinking required to understand subject-specific texts successfully is tightly connected to the specific discipline language. Finally, Gee also argued that schools have done a poor job of helping students understand subject-specific academic language: “At best [schools] believe you can teach children to think (e.g., about science and math) without worrying too much about the tools children do or do not have with which to do that thinking” (p. 3). In relation to my study, if teachers are metalinguistically aware of how they engage with discipline-specific texts, they will have a higher capacity to teach discipline-specific literacy practices to students.

Importance of Culturally and Linguistically Diverse Students

Secondary classes consist of a wide variety of culturally and linguistically diverse (CLD) students. This diverse population of students is significant to the teaching of discipline-specific literacy. According to Cummins, Markus, and Montero (2015), the characteristics of student diversity include having a low socioeconomic status, being multilingual, and being from marginalized student groups. These factors affect student identity, including their background knowledge, experience, and understanding of the information being taught in secondary

classroom contexts. When providing effective instruction to CLD students, Cummins and Early (2015) recommend scaffolding meaning, activating and building student background knowledge, and extending student understanding of academic language. Cummins and Early (2015) also point out that it takes “at least five years” (p. 12) for students who do not speak English as a first or native language to acquire the same level of academic language proficiency as their native English speaker peers. These researchers identify the value of adding multimodal means to the teaching of these pedagogical strategies. In order to meet the learning needs of students with diverse backgrounds, Cummins and Early (2015) emphasize that schools need to create meaningful connections with students, including their interests and their cultural and linguistic experiences both within and beyond their classrooms.

CLD student identity needs to be considered when teaching discipline-specific literacy. According to Holloway (2021), students require metacognition understanding to apply the “heuristic, vocabulary, and protocols” (p. 309) inherent in each discipline. The specific learning needs of CLD students make the building of metacognition more challenging. Flint and Stuart (2019) recommend teachers could overcome language obstacles by developing relationships with students via literacy activities implemented across disciplines. Holloway (2021) suggests using multiliteracies to develop inventive pedagogical approaches in the disciplines to create “interesting and engaging learning opportunities” (p. 307) for CLD students. CLD student literacy is a critical component of understanding and implementing discipline-specific literacy.

Current Research on Secondary Discipline Specialists and Discipline-Specific Literacy

Research on discipline specialists and their interactions with discipline-specific texts has been significant. Much of it aims to equip teachers to help secondary students understand texts more effectively. Inquiry into disciplinary literacy has spanned decades. Studies that are

important to my research focus on the following: metalinguistic awareness of secondary teachers (Andrews, 1997); lexical and grammatical patterns typical of disciplinary texts, and the improvement of secondary student “literacy skills and academic underperformance” (Fang, 2012b, p. 19); metalinguistic protocol (McArthur, 2012); SS disciplinary literacy (Damico et al., 2009); comprehension understanding in teacher practice (Byers et al., 2012); reader understanding in mathematical exposition as found in textbooks (Shepherd & van de Sande, 2014); construction and validation of disciplinary literacy (Spires et al., 2018); in-service teacher understanding of disciplinary literacy implementation and collaboration with researchers in a disciplinary literacy project (Lee, et al., 2021); disparity of disciplinary literacy in relation to the reasoning demanded by engineering design (Paugh & Wendell, 2021); analysis into the limited research about the professional development of in-service teacher disciplinary literacy instruction delivery (Howell et al., 2021); different uses of literacy in history, chemistry, and math (Shanahan et al., 2011); and think-aloud protocol (Shanahan et al., 2011).

Andrews (1997) inquired into the metalinguistic awareness of secondary teachers in Hong Kong. The study’s main goal was to investigate “the relationship between a teacher’s metalinguistic awareness and her ability to explain a grammar point: how might the latter be affected by the former, and what might the latter reveal about the former?” (p. 147). Andrews explored the Advisory Committee on Teacher Education Qualifications’ (ACTEQ) second teacher competency “for the language used in the classroom in order to teach the major language teaching subject effectively. This competency will entail an element known as ‘language awareness’ and will be referred to generally as **pedagogic content knowledge**” (p. 148). Fourteen teachers with varying backgrounds and teaching experience were asked to act out ‘the explanation of a grammar point on two separate occasions’ (p. 147). Andrews’ (1997) study

confirmed that teacher metalinguistic awareness is a multifaceted concept partly because “it overlaps with and interacts with so many other facets of teacher belief, assumption, knowledge and behaviour” (p. 160). Through this study, Andrews established that more research needed to be conducted to determine teachers’ knowledge about language. By researching the reading engagement process of discipline-specific specialists, I gathered more insight into teachers’ language knowledge.

In Fang’s (2012b) study, which consisted of text analysis with no participant involvement, he “describes the lexical and grammatical patterns typical of disciplinary texts in the subjects of language arts, science, mathematics, and history” (p. 19). His research supported disciplinary literacy through a functional focus on language. By analyzing two texts from each of the four subjects, Fang recognized subject-specific functional language. The study presented three significant findings. The first discovery relates to literacy instruction in academic disciplines, which Fang (2012b) emphasizes needs to go beyond the generally accepted focus on basic skills, general cognitive strategies, and generic learning strategies “to embrace an emphasis on discipline-specific practices that promote simultaneous engagement with disciplinary language and disciplinary content” (p. 19). The second finding is that for students to participate with disciplinary learning effectively, they “need to expand the repertoire of language skills they have developed during the early years of schooling, learning to recognize how language is used in different disciplines to present knowledge, give value, and create specialized texts” (p. 33). The third discovery is connected to the second. The new student literacy ability that is needed is most effectively acquired with the assistance of educators in disciplinary milieus. These teachers require knowledge of both disciplinary content and disciplinary language. As Fang (2012b) points out, “it is through participation in discipline-specific practices of reading, writing, talking,

inquiring, thinking, and reasoning that disciplinary knowledge and disciplinary habits of mind are used, shared, critiqued, refined, and expanded” (p. 33).

McArthur (2012) explains how she has improved her instruction of a university content-area literacy course by using a metalinguistic protocol over a five-year period, maintaining that this protocol “becomes a tool for making disciplinary literacies visible for teaching and learning” (p. 28). She focused this protocol on four disciplines: science, mathematics, social sciences, and the arts and humanities. In preparation to engage with McArthur’s (2012) metalinguistic protocol, pre-service teachers examine “the reading process and the cognitive strategies such as predicting, inferring, sampling, confirming/disconfirming, ...” (p. 32) via readings, discussions, and experiences. Students are then introduced to a metalinguistic protocol that entails a three-part assignment: “a metalinguistic think-aloud journal homework assignment; an in-class partner trade and discussion; and an individual reflection of the experience” (p. 33). Each assignment gives students the opportunity to achieve a greater understanding of how discipline specialists think. Over the five years that McArthur used this protocol, students consistently remarked that through its use, they gained insights into three major areas: the reading process and reading strategies; the role of disciplinary background knowledge in reading to learn; and socially situated literacies, which includes disciplinary literacy and the unique way of thinking and of using language in the disciplines of knowledge (McArthur, 2012, p. 51). McArthur (2012) emphasizes, “What is needed is more understanding about disciplinary literacy and how preservice content area teachers might use those literacy practices with their less experienced adolescent students” (p. 51). My research delves into secondary teacher metalinguistic awareness of discipline-specific texts, which provides insight into how pre-service teachers can become

more knowledgeable about the literacy practices they use, as well as those they still need to learn about.

In their research, Damico et al. (2009) explore “the possibilities of disciplinary literacy in social studies as they examine how four classes of ninth-grade students in an East Asian international school used a set of Web-based technology tools to evaluate two competing webpages ...” (p. 325). The research features students who employed these tools as they evaluated the two texts within SS classes. Damico et al. point out the possible benefits of understanding secondary subject matter teaching and learning as an amalgamation “of metacognitive reading strategies and metadiscursive skills of the discipline, especially how this integration might center upon the cultural resources and contextual knowledge that readers bring with them to texts” (p. 325). Pedagogically, these researchers assert one key disciplinary literacy practice in SS is students’ abilities “to access and mobilize their own cultural and contextual knowledge” (p. 325) as demonstrated in the context of one secondary school. Damico et al. (2009) emphasize that their findings point “to a necessary next pedagogical step: the willingness and ability of teachers and students to rigorously evaluate this knowledge” (p. 325). This research is significant, pointing to secondary student metacognitive ability as they read web-based historical documents. Students need to critically appraise texts, asking themselves good questions; they also need to be taught how historians think.

Byers et al. (2012) conducted an action research project, which posed the question: “What counts as comprehension in teacher practice?” (p. 18). To answer this question, they investigated teacher and student understandings of comprehension in the middle school years—specifically Years 5, 7, and 9 (p. 18). Byers and colleagues embarked upon this research because the participating middle-school staff felt ill-equipped to alleviate their literacy concerns “about

the difficulties students experience in understanding the ‘deeper concepts’ of content in the curriculum, and the perceived lack of strategies teachers have for teaching these understandings, within a crowded and content driven [Australian] curriculum” (p. 18). They were particularly perplexed when comprehension instruction was to be placed “as part of the curriculum or academic discipline in middle years classrooms” (p. 18). An online questionnaire was given to Year 5, 7, and 9 students and their teachers. Byers et al. asked students to comment about three areas: their understanding of comprehension; which subjects they used comprehension in; and in which subjects they received assistance from their teachers regarding comprehension (p. 21). Through the questionnaire and interviews, teachers were asked to comment on the following: their definition of comprehension in relation to their subject area; whether they explicitly taught comprehension strategies; which strategies they taught and the effectiveness of the strategies; any specific student comprehension weaknesses; and their own confidence in instructing comprehension (Byers et al., 2012, p. 22). These researchers also asked teachers, “in which areas of comprehension they would like further professional development” (p. 22). In their concluding remarks regarding teaching subject-specific comprehension strategies, Byers et al. emphasize the need to empower “classroom teachers with knowledge and understandings of comprehension strategies, and provide them with the tools to successfully implement these in their classroom” (p. 26).

Shepherd and van de Sande’s (2014) study was designed to better understand how mathematically more advanced readers (faculty members) read for understanding in mathematical exposition as found in textbooks, compared to first-year (novice reader) undergraduate students (p. 74). Shepherd and van de Sande (2014) compared the reading strategies used by three faculty members and the reading strategies of three undergraduate

students. The results of analyzing questionnaires, interviews, two-hour reading sessions, and think aloud, demonstrated that their participants used three dimensions that contribute to successful comprehension of mathematical exposition: mathematical fluency, comprehension monitoring, and engagement (p. 77). From the evidence provided by this study and previous research, Shepherd and van de Sande (2014) propose the use of a Mathematics Reading Framework, which presents “the strategies that first-year undergraduate students use for reading exposition in their mathematics textbooks” (p. 74).

Through their research, Spires et al. (2018) aspired to “construct and establish the validity of disciplinary literacy, which has recently gained attention from the implementation” (p. 1401) of new curriculum. These researchers targeted the key literacy practices in which educators in the four core subject areas—science, history, ELA, and math—engaged while reading and writing in the disciplines. Scales were developed and administered to a snowball sample of professionals found nationwide. According to these researchers, the data revealed proof “of disciplinary literacy as a multidimensional construct with three related factors: source literacy, analytic literacy, and expressive literacy” (p. 1401). They concluded that among the four core disciplines, a minimum of three operational types of literacy are identified. Spires et al. explain that these factors of literacy differed substantially between the four core disciplines, supporting the notion that each discipline uses literacy uniquely. These researchers claim that “This is the first study of its kind to attempt to define, quantify, and validate the construct of disciplinary literacy” (p. 1401).

Paugh and Wendell (2021) conducted a bounded case study investigating disciplinary literacy instruction integrated inside an elementary engineering unit in an urban classroom. Their interdisciplinary research team consisted of university literacy and engineering educators and

classroom teachers. Instruction and analysis were informed by “a social semiotic language theory (systemic functional linguistics) and a framework of mechanistic reasoning” (p.122). Paugh and Wendell’s (2021) study demonstrates how a flexible collection of disciplinary language options functioned to assist students’ developing thinking as a component of the engineering design process. This study provided two important insights. First, the findings contribute awareness of synergy amid language and thinking as a habit of design. Second, these findings highlight the alignment of STEM literacy and core disciplinary practices within both ELA standards and the Next Generation Science Standards.

Lee et al.’s (2021) qualitative design-based research aspired to enhance the current understanding of how in-service teachers understand “and implement disciplinary literacy and in what ways they collaborate with researchers in a disciplinary literacy project” (p. 220). They collected and analyzed transcripts of the meetings from a disciplinary literacy project that was a university–school partnership between history teachers, literacy education researchers, and social studies education researchers. The data analysis comprised an application of a constant comparative method which identified “three salient themes: collaboration, text use, and instructional practice” (p. 220). The teachers in the study cited that “the triangular structure of the collaborative expertise of teachers, literacy, and social studies education researchers was useful in constructing professional and instructional knowledge” (p. 220). Regarding text use, teachers stated that “the intentional selection and teaching of multiple and multimodal texts provided diverse perspectives and supported the various ways in which students read and learn” (p. 220). Pertaining to instructional practice, the teachers showed that disciplinary literacy and thinking skills should be deliberately “taught and that methods for enhancing discipline-specific motivation should be considered” (p. 220).

Howell et al. (2021) assert that although the emphasis on disciplines as cultures of distinct literacy practice has been incorporated into curricula and national standards, a paucity of research exists that investigates in-service teacher professional development (PD) specific to disciplinary literacy instruction delivery. Through a systematic qualitative literature review, Howell et al. inquire into this disparity through the analysis of “58 articles using the search phrases professional development, disciplinary literacy, and content area literacy” (p. 1). These researchers consider four specific themes that have emerged in disciplinary literacy research pertaining to PD: “disciplinary literacy as strategy instruction, differentiation and disciplinary literacy, measures of disciplinary literacy, and a PD model” (p. 1). They discuss theoretical codes revealing both successes and challenges for disciplinary literacy PD, with implications for future PD.

A study by Shanahan et al. (2011) described “educationally relevant differences in literacy use among three subject-matter disciplines—history, chemistry, and mathematics” (p. 393). Their main study purpose was to improve the literacy-teaching preparation in a secondary preservice teacher education program by identifying specific literacy features and use in the three disciplines. Participants were assembled into three discipline-specific teams that included two disciplinary (history, chemistry, and mathematics) experts, two pre-service secondary teacher educators who prepare teachers to instruct those disciplines, and two high school teachers from each discipline (p. 393). The inclusion of mathematicians and chemists was important because little data exists regarding the exploration of literacy and literacy use in these disciplines. Using think-aloud protocols and interviews, this research identified important differences in the reading behaviours of the six disciplinary experts (university professors). According to Shanahan et al., the teacher educators and teachers “also participated with the disciplinary experts in [protocols]

focus-group discussions ... and their reactions and insights helped the disciplinary experts to articulate their approaches and to determine implications of the reading behaviors that were observed” (p. 393). This Shanahan et al. study was significant in formulating my research questions and encouraged me to use think-aloud protocol as a data collection tool.

This research on disciplinary literacy and discipline specialists and their interactions with discipline-specific texts informed my investigation of the four secondary discipline specialists’ ability to explain their metalinguistic awareness of reading discipline-specific texts. That the teachers were discipline specialists was an important aspect of my participants’ multi-faceted metalinguistic awareness (Andrews, 1997) and their ability to explain their thinking. The literature also informed my study’s further exploration of teacher metalinguistic awareness by having participants share their metacognition thinking using interviews and think alouds (Shanahan et al., 2011). I wondered: If teachers have the metalinguistic awareness, could it assist them to be more aware of the Discourse needed to better communicate the discipline-specific thinking that adolescents require in order to understand texts? In-service teacher metalinguistic awareness of discipline-specific texts could help diminish their resistance (Cantrell et al., 2009; Fine et al., 2011; Hinchman & O’Brien, 2019; Malmström & Pecorari, 2021) to ownership of teaching discipline-specific literacy in secondary classrooms.

The next section contains an explanation of what reading in the disciplines entails.

Reading in the Disciplines

Disciplines each have their distinctive aspects of thinking and knowledge structure, including discourse use and ways of observing and reading the world—differences which McArthur (2012) explains as follows:

science as an empirical way of knowing using logic to think with the scientific methods; mathematics as a logical way of knowing using mathematical methods of thinking; ... history, as a factual way of knowing pre-determined by authority with cause and effect thinking about how the past informs as the present; and the arts and humanities as aesthetic ways of knowing and communicating thinking through the language of the sign systems ...” (pp. 27–28)

Lent, an international educational consultant and author, correlated a list of discipline-specific literacy characteristics. When reading in the disciplines (science, SS, ELA, and math), Lent (2016) explains that particular literacy practices are required by the various disciplines.

Shanahan and Shanahan (2008) explain some similarities and differences between disciplines:

Although the disciplines share certain commonalities in their use of academic language ... they also engage in unique practices. That is, there are differences in how the disciplines create, disseminate, and evaluate knowledge, and these differences are instantiated in their use of language.” (p. 48)

Lent (2016) categorizes the disciplines into the sciences, mathematics, social studies (which include history and the social sciences), and ELA (which includes fiction and non-fiction reading). Within these categories, Lent (2016) provides reading characteristics that readers need to employ in order to understand discipline-specific texts. I will use Shanahan and Shanahan’s (2008, 2012) discipline-specific literacy practices to supplement Lent’s lists. Additionally, for reading as a mathematician, I will employ Shepherd and van de Sande’s (2014) three dimensions of reading math texts. Appendix A contains a chart that lists the reading practices suggested for all four disciplines by Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014).

Shanahan and Shanahan (2008) emphasize that experimentation is a scientist's primary method of creating knowledge. To engage successfully with a science text, Lent (2016, p. 17) suggests that the reader needs to read using various literacy practices, including assuming an objective stance, searching for answers to relevant questions, and sifting through and evaluating quality and quantity evidence. Shanahan and Shanahan (2008) claim that chemists, specifically, "were most interested in the transformation of information from one form to another" (p. 49). These forms or representations of information can be pictures, graphs, charts, text, or diagrams. When reading prose, chemists visualize "writing down formulas" (p. 49). If a diagram or chart were on a page, a chemist would "go back and forth between the graph and the chart" (p. 49). Shanahan and Shanahan (2008) point out that as the reading of chemistry texts progress, the various representations are processed recursively. A high lexical density is a characteristic of science texts, and in chemistry, particularly, Shanahan and Shanahan (2008) point out that "concepts build upon each other, and these concepts can then be built upon each other" (p. 55). Physicists, according to Shanahan and Shanahan (2012), tended to focus on two types of information—information that was not a part of their knowledge as well as information that interrupted their expectations.

Lent (2016) explains that in order to successfully read a SS text as a historian or a social scientist, the literacy practices required by readers include the ability to: compare and contrast events, accounts, documents, and visuals such as infographics or photographs; interpret primary and secondary sources with an eye toward bias; and create narratives from existing information using knowledge of the present to make sense of the past and vice versa (p. 19). Shanahan and Shanahan (2008) emphasize the importance of a historian being aware of the author or source. One of the major purposes of historians' reading is to decipher what story the author wants to

tell. They go onto point out that the historian needs to read, knowing they are getting an interpretation of history and not “Truth” (p. 50). A historian needs to be aware of two biases—those of the text’s author(s) and their own. Shanahan and Shanahan (2008) also emphasize that “historians infer cause-and-effect when they study events and what precedes and follows them” (p. 56). Hernandez and Schleppegrell (2021) concur, indicating that readers of SS texts “engage in inquiry about important questions by reading and analyzing sources, seeking corroboration and contextualizing evidence, and considering the perspectives of different historical actors” (p. 449).

In order to successfully read an ELA text, Lent (2016) suggests that a reader of fiction and non-fiction texts (what I refer to as an English major) needs to employ various literacy practices, including: looking for ways that characters, setting, and conflict may influence the meaning of the text; understanding the use and effect of figurative language; finding underlying messages that evolve as a theme; reading skeptically; discerning unreliable narrators or characters; and recognizing devices authors use to enhance their writing, such as flashbacks, hyperbole, or analogy (p. 20).

For comprehending mathematics texts, Lent (2016) explains that various literacy practices are used including: using the information they are reading as pieces of a puzzle to be solved; making meaning out of mathematical symbols and abstract ideas; and acting as investigators looking for patterns and relationships (p. 18). From Shanahan and Shanahan’s (2008) research, when understanding vocabulary, it is important to reread math texts to ensure the reader is understanding “the precision of meaning, and each word must be understood specifically in service to that particular [mathematical] meaning” (p. 49).

Shepherd and van de Sande (2014) recommend three dimensions that contribute to successful comprehension of mathematical exposition: mathematical fluency, comprehension monitoring, and engagement (p. 77). Readers require the ability to automatically translate written text into understandable ideas, to decode mathematical symbols and to understand vocabulary. Skimming is used effectively when reading familiar information. Reading-the-meaning was also demonstrated while successfully using mathematical fluency. Comprehension monitoring is also a necessity for reading comprehension. Reader perseverance and the willingness to repair lost understanding is a part of comprehension monitoring. Engagement requires readers to examine the text and search beyond the passage to attain understanding by looking for further examples or information that informs their learning. The reader uses text features such as diagrams in the texts.

In my research, I wanted to determine whether the participants in this study used the literacy practices recommended by Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014). One of the skills needed in order to use various literacy practices is specific background knowledge. For teachers, background knowledge includes teachers' content knowledge.

Teachers' Content Knowledge

Teachers have their sets of background knowledge and understandings about the students and subjects they teach. Their job is complicated, and requires knowledge and understanding about how to teach, as well as, according to Shulman (1986), the ability to evaluate, differentiate, be culturally aware, and know the various educational policies and procedures and pedagogical theories. Shulman's (1986) three categories of teachers' content knowledge (TCK) are content

knowledge, pedagogical content knowledge, and curricular knowledge (p. 9). Fang (2014) adds, “literacy pedagogical content knowledge” (p. 445) to these categories.

Shulman (1986) explained that content knowledge is the “amount and organization of knowledge” (p. 9) in teachers’ minds. Each discipline or subject has its organization or structure that includes both substantive and syntactic structures. The substantive structures are the different methods by which each discipline’s concepts and principles are organized to incorporate its facts. Shulman (1986) emphasized that teachers must be able to define accepted truths within a subject for students, as well as to explain “why a particular proposition is deemed warranted, why it is worth knowing, and how it relates to other propositions, both in theory and in practice” (p. 9). According to Shulman (1986), discipline’s syntactic structure is “the set of ways in which truth or falsehood, validity or invalidity are established” (p. 9). If a question arises about the validity between two ideas within a discipline, the syntax of the discipline sets the rules to establish which idea has greater merit.

TCK is expected to include pedagogical content knowledge (PCK), which is “the dimension of subject matter *for teaching*” (Shulman, 1986, p. 9) or a distinctive form of professional insight. Deng (2007) explained that the concept of PCK transforms “the subject matter of an academic discipline into pedagogical forms” (p. 279).

According to Shulman (1986), PCK has two foundations. The first is that academic disciplines are the chief foundation of what teachers teach and students study in school, and PCK distinguishes the understanding of content specialists from that of pedagogues. The other underpinning is that classroom teachers transform the subject content of an academic discipline into school subject matter. Shulman’s description of PCK includes (a) the most regularly taught topics in a subject area, (b) the most useful forms of representation of those ideas, and (c) the

most powerful analogies, illustrations, examples, explanations, and demonstrations. According to Kleickmann et al. (2013), PCK has two core facets to its knowledge: “the knowledge of students’ subject-specific conceptions and misconceptions as well as knowledge of subject-specific teaching strategies and representations” (p. 91). These teaching ideas can be based on theory or practical experience.

The third category of Shulman’s (1986) teacher content knowledge is curricular knowledge. This category includes knowledge of the subject’s government-mandated curriculum—the Program of Studies in Alberta—as well as the programs, resources, textbooks, and other instructional materials that help teachers teach the curriculum. When teachers know which resources are available, they are more likely to know which resource is best used to teach particular parts of the curriculum. The mandated curriculum is the foundation of the subject content they teach.

Literacy pedagogical content knowledge (LPCK), according to Love (2009), consists of three elements. The first is “the knowledge of how spoken and written language can be best structured for effective learning” (p. 541). Second is the “recognition that subject areas have their own characteristic language forms and hence distinctive literacy practices” (p. 541). The third element in LPCK is “the capacity to design learning and teaching strategies that account for subject-specific literacies and language practices” (p. 541). No matter what aspect of teacher content knowledge is being employed, it is helpful for teachers to be aware of their thinking.

Metacognition

The ability to understand how we think is an important skill for people of all ages (Dawson, 2008; Flavell, 1979; Imel, 2002; Schneider, 2008; Thomas, 2006). Chick, (2016) noted that metacognition includes an acute cognizance of our thinking and learning as well as of

ourselves as thinkers and learners (Cheng & Chan, 2021). John Flavell (1979), a developmental psychologist, coined the term metacognition and explained that it is a cognitive process that includes the actions and interactions of the following phenomena: metacognitive knowledge; metacognitive experiences, goals, or tasks; and strategies or actions (p. 906). Individuals use goals or tasks and strategies or actions in the phenomena of metacognitive knowledge and experiences. According to Flavell (1979), goals (tasks) are “the objectives of a cognitive enterprise,” and strategies (actions) are “the cognitions or other behaviors employed to achieve them” (pp. 906–907). I refer to goals and tasks as I explain metacognitive knowledge and experiences.

Metacognition is complex. The literature review revealed no single agreed-upon definition (Thomas, 2012), but I will present a few definitions and explanations of this term. Flavell (1979) noted that metacognitive knowledge involves knowledge or beliefs about the factors or variables that act and interact in ways to influence the course and result of cognitive enterprises (p. 907). These factors or variables are categorized into person, task, and strategy. Cleeremans et al. (2020) define metacognition or cognition about cognition as “operations by which one consciously evaluates and controls one’s own cognitive processes” (p. 113). Dawson (2008) identified metacognitive knowledge categories to include being aware of available strategies and when to use them (strategies), having beliefs about personal and interpersonal differences (person), and being able to recognize which cognitive activity is necessary for a particular situation (task). Cheng and Chan (2021) characterize metacognition as “the ability of individuals to understand and manipulate their own cognitive processes, to acquire information about their cognitive structure and being able to organise it” (p. 11). The use of metacognitive knowledge can be conscious or unconscious (Cleeremans et al., 2020). An

example of metacognitive knowledge would be when a person recognizes that, in contrast with their peers, they are better able to understand science concepts than to recognize a theme in fiction.

Metacognitive experiences, according to Flavell (1979), are “any conscious cognitive or affective experiences that accompany and pertain to any intellectual enterprise” (p. 906). A metacognitive experience occurs when people become aware that they do not understand something they are trying to learn and, as Dawson (2008) explained, they intentionally participate in reflective intellectual activities such as problem-solving and learning. Dawson identified three effects of metacognitive experiences: (a) they can be short-lived or long-lasting, such as when individuals struggle with perplexing conundrums; (b) they can add to people’s metacognitive knowledge base, and (c) they can guide people in revising or abandoning old goals or creating new ones. Cheng and Chan (2021) point out that metacognitive experiences can occur “before, during or after a task” (p. 14). By reviewing, adding, or deducting items in their metacognitive knowledge repertoire, Cheng and Chan explain that individuals can make adjustments in reaction to their metacognitive experiences (14).

Dawson (2008) clarified that knowledge becomes metacognitive—rather than merely cognitive—if people use knowledge strategically to meet their goals. People use their metacognitive skills when they understand how to accomplish specific tasks and ensure that they do so correctly. According to Chick (2016), as people engage metacognitive skills, they become more cognizant of their abilities as group members, learners, writers, test-takers, and readers. It is important that individuals first recognize their limitations and then learn how to expand their capabilities. Bransford et al. (2000) wrote that as people learn and recognize their strengths and weaknesses, they will more likely “actively monitor their learning strategies and resources and

assess their readiness for particular tasks and performances” (p. 67). Monem (2015) suggests that self-scaffolding is effective metacognitive tool, which necessitates the learner to break a problem into sub-problems. By solving each sub-problem, the learner solves the big problem. According to Cheng and Chan (2021), metacognition requires motivation from learners.

Jacobs and Paris (1987) explained that metacognition could be divided into two broad categories: self-appraisal of cognition and self-management of thinking (p. 258). Self-appraisal of thinking, according to Jacobs and Paris, can be categorized into declarative, procedural, and conditional knowledge (p. 259). Declarative knowledge is “what is known in a propositional manner” (p. 259). Procedural knowledge is awareness of cognitive processes, which is an essential characteristic of metacognition. Conditional knowledge is “an awareness of the conditions that influence learning, such as *why* strategies are effective, *when* they should be applied and *when* they are appropriate” (p. 259). Self-management of thinking, according to Jacobs and Paris’s, is “the dynamic aspect of translating knowledge into action” (p. 259). They grouped the self-management of thinking into three types: planning, evaluation, and regulation. Planning is the careful coordination of a thinking means and a thinking goal. Readers who plan to self-manage their cognition regulate reading rate and comprehension standards to fit the reading purposes and any constraints. Readers use evaluation, the second self-management dimension, to assess whether they comprehend what they read. Regulation takes place when readers monitor their progress and revise or adjust their plans and strategies, depending on their efficiency. Reading and comprehension, Cheng and Chan (2021) point out, are fostered by metacognitive ability.

Metalinguistic Awareness. Metacognition is the knowledge or awareness that is important for most activities. When people apply metacognition to language learning, including

reading, they engage in a metacognition subcategory called *metalinguistic awareness* or *metalinguistic metacognition* (Nagy & Scott, 2013). According to Tunmer and Herriman (1984), this type of metacognition helps people to monitor and control their language use cognitively, as well as to view language as code and separate it from its symbolic meaning. Metalinguistic awareness is also the ability to think about language and language structure objectively (Bessy & Knouse, 2020). Moore (2021) points out that someone who is metalinguistically aware has the “ability to systematize knowledge about language and use that knowledge to monitor language as language” (p. 178). The subcategories of metalinguistic awareness are morphological, syntactical, and word or vocabulary awareness (Nagy & Scott, 2013). As with other types of metacognition, people possess varying degrees of metalinguistic awareness.

Thomas (2012) described metacognitive individuals as people who consciously undertake activities—both intellectual and physical—and monitor, evaluate, and reflect on the progress of the activity to improve their practices. According to Moore (2021), “metalinguistic understanding is conscious but not necessarily explicitly articulated. Speakers make judgments by calling on [metalinguistic awareness], even if they do not or cannot articulate what they know about language” (pp. 179–180). Metalinguistic awareness is an imperative skill for successful reading. As the teacher participants took part in my research, they needed to be attuned to their metalinguistic awareness—self-appraisal of cognition and self-management of cognition—as they read subject-specific texts. Their ability to communicate these reading skills benefitted this research. With prior knowledge that includes discipline expertise, teachers learn actively. Their metalinguistic awareness of discipline-specific literacy practices has become automatic; they are not mindful of all the thinking that occurs as they interact with texts.

What is essential to this research is that if teachers are metalinguistically aware of the disciplinary-literacy-practice thinking, they have a better chance of teaching and modelling for their students how to navigate the various texts effectively. Paris and Winograd (1990) claimed there are two benefits to such “consciousness-raising” (p. 15). The first is that it transfers responsibility from teachers monitoring student learning to self-monitoring by the students themselves. The second benefit “promotes positive self-perceptions, affect, and motivation among students” (p. 15). Metacognition then bestows individual understandings into each student’s thinking and encourages autonomous learning. To have a metalinguistic understanding, according to Myhill (2011) there needs to be an “explicit bringing into consciousness of an attention to language as an artifact, and the conscious monitoring and manipulation of language to create desired meanings grounded in socially shared understandings” (p. 250). When applying metacognition to reading, it is helpful for teachers to be aware of the literacy practices they use as they read.

Automaticity. Being able to verbalize metalinguistic awareness can be difficult. Bodrova and Leong (2007) express that ideas, concepts, strategies, and theories become so much a part of a person’s verbal thinking that they are what the seminal researcher Gal’perin (1969) calls automatized (Bodrova & Leong, 2007, p. 70); the thinker is not aware of their utilization. Wasserman and Wasserman (2016) define automaticity as “a behavior or emotion that is so practiced, it emerges without conscious effort” (p. 70). Kuhn et al. (2010) point out that as the automaticity of any skill develops the learner’s performance becomes both accurate and faster. Effortlessness and a lack of conscious awareness are also characteristic of automaticity (Kuhn et al., 2010). Regarding reading, Rawson (2010) explains the concept of automaticity is not explicitly defined in reading comprehension research because researchers and laypersons have an

intuitive sense of what it means to do something automatically. Rawson (2010, p.187) continues in an intuitive sense; automaticity refers to “quick, easy, and outside of conscious awareness” (Rawson & Touron, 2015).

Young and Rasinski (2018) and other scholars (Godde et al, 2020; Allington & McGill-Franzen, 2009) point out reading fluency is constituted by word recognition, automaticity, and reading prosody (p. 2). Young and Rasinski (2018) and Roembke et al. (2021) note that automaticity in the context of reading fluency is the ability to quickly read words with the least cognitive work. Rasinski (2006) adds that readers need to “be able to decode words correctly and effortlessly (automaticity)... then put them together into meaningful phrases with the appropriate expression to make sense of what they read” (p. 704). Baker and Beall (2009) concur with Rasinski (2006) that automaticity is taught and encouraged as people learn to read. According to Thurlow and van den Broek (1997), Samuels et al. (2006), and Roembke et al. (2021) automaticity influences more than reading fluency, in that many reading cognitive processes become automatized.

Samuels et al. (2006) highlight the importance of metacognition automaticity, and to emphasize this significance, point out four tasks essential to reading comprehension: word decoding and recognition, word comprehension, metacognition, and the cognitive effort that is necessary to perform the other three tasks (p. 44). Until these tasks become automatized, beginning readers find reading difficult. Paige et al. (2014) suggest that “When automaticity exceeds the rate at which adequate comprehension occurs, the attentive reader reduces automaticity to promote comprehension. As such, additional automaticity will not contribute to greater comprehension” (p. 129). These researchers propose that automaticity may increase as comprehension increases.

When readers become proficient, Samuels et al. (2006) explain that automated practices that enable reading comprehension transpire so effortlessly and so quickly that readers are often unaware they are formulating automatic inferences. Illustratively, for automatic inferences to occur, readers need to activate background knowledge to comprehend text. This background knowledge activation becomes so automatic that readers do not realize the process is occurring. Samuels et al. (2006) emphasize that “all comprehension involves automatic inferences” (p. 44) and other automatic cognitive processes. Once a reader has automatized their thinking it is difficult for them to voice the thinking. Pressley and Afflerbach (1995) explain that researchers are not sure how the plethora of thoughts are changed before they are verbalized as “inner speech” that can be spoken out loud. Ehrlich (2006) describe inner speech, as a result of higher thought, which occurs through a series of developmental stages,

going from the external world and travelling inwards, its genesis a product of an initial need to solve problems. This inner speech constitutes a separate language function that is centred on word sense and meaning and has its own syntactic structure (p. 15).

One of the problems with inner speech is making it conscious. Larrain and Haye (2012) explain that “consciousness is structured by language, exploring the concept of internalization, and making an analogy between acts of thinking and uttering.” (p. 3)

One of the problems with externalizing and verbalizing “inner speech” is what Vygotsky (1987) called thinking that has been “folded.” When reasoning becomes folded, a person thinks of many ideas simultaneously and may not be aware of all they are thinking at one time. Bodrova and Leong (2007) explain, “Although you may be aware of the final product, it takes a concerted mental effort to ‘unfold’ or draw the ideas back into consciousness” (p. 70). The unfolding process takes much effort. When people try to unfold thinking, automaticity hinders the

unfolding process. What a person thinks as they read is almost hidden in their minds (Bodrova & Leong, 2007). For example, most adults will answer $3 + 3 = 6$, with little if any thought about the answer. Shepherd and van de Sande (2014) explain that the “translation of mathematical symbols to meaning is nearly automatic” (p. 79).

In their study of learning to be conscious, Cleeremans, et al. (2020), define consciousness as a concept that involves, at the minimum, three distinctions:

the distinction between phenomenal consciousness and access consciousness; the distinction between awareness of the world (perceptual awareness), self-awareness, and awareness of other people’s mental states (theory of mind); and the distinction between states (e.g., sleep versus wakefulness) and contents of consciousness. (p.113)

These researchers claim that consciousness is “the brain’s implicit, embodied, enactive, and nonconceptual theory about itself” (p. 121) and that consciousness always involves a form of subpersonal metacognition. Automatized thinking is included in the unconscious. Cleeremans et al. emphasize that “consciousness should be viewed as a process that results from continuously operating unconscious learning and plasticity mechanisms” (p.112). These researchers also explain that the unconscious can become conscious through learning. As humans, when we automatize strategies that we use and rely on regularly, they become part of our unconscious cognition. To get to a state of consciousness, they suggest one must be aware of and sensitive to the current situation (p. 113). Related to consciousness and unconsciousness is the ability to make implicit thinking explicit, which is a challenge.

Whatever the thinking, language is used, and specific language is used at specific times. Teachers of disciplinary literacy require specific thinking and language to communicate their reading literacy practices.

Categorization of Literacy Practices

This section contains information gleaned from the literature used to analyze the metalinguistic awareness of the participants in this research. I arranged this section into three categories: (a) reading skills and strategies, (b) thinking processes, and (c) background knowledge each containing specialist language used as *nonvernacular social language* (Gee, 2014). These categories would be considered content-based literacy or generic reading strategies. According to Di Domenico et al. (2018), these strategies are “important scaffolds for disciplinary habits of reading, writing, talking, and thinking” (p. 83). Concurring with Fang and Coatoam (2013), for discipline-specific literacy to be successful, readers require the ability to use content-based literacy practices applied to discipline-specific texts and discipline-specific reading special characteristics (Lent, 2016; Shanahan & Shanahan, 2008, 2012; Shepherd & van de Sande, 2014).

Reading Skills and Strategies. Many researchers (Alvermann & Moje, 2013; Ruddell & Unrau, 2013; Huey, 1968; Goodman, 1988, 1996; Shepherd & van de Sande, 2014) agree, whether readers are required to understand the alphabet or non-alphabetic writing systems, reading is learned, practiced, and honed over the course of a lifetime. Reading in its complexity requires the reader to decode, to be fluent, to use prosody, to understand the various morphemes, and then to combine all these skills in order to understand (Goodman, 1988, 1996). In this section, I define reading skills and strategies and then list the thinking processes used as reading strategies.

To be a successful reader, students are required to use literacy practices such as specific skills and strategies. The term *reading skills* has been used in Kindergarten through Grade 12 curricula since the 1950s; whereas, in order to signify the cognitive features of information

processing, employment of reading strategies became popular in the 1970s. According to Afflerbach et al. (2008), over the years, these skills and strategies have been used interchangeably by teachers, researchers, and publishers, to represent what readers do when they are engaged with the written word. It would be pertinent to make clear distinctions between the two.

The definitions used for this research are from Afflerbach et al. (2008), who define reading skills as “automatic actions that result in decoding and comprehension with speed, efficiency, and fluency and usually occur without awareness of the components or control involved” (p. 368). Any automatic action the reader performs while reading would be considered a skill according to this definition. These same researchers define reading strategies as “deliberate, goal-directed attempts to control and modify the reader’s efforts to decode text, understand words, and construct meaning” (p. 368). A strategic reader will consciously decide what needs to be done in order to understand the text. Reader accomplishment determines when a strategy becomes a skill. When a strategy—such as slowing down when reading a more difficult passage—becomes automatic, then the automaticity changes the strategy to a skill. A successful reader will know when they need to be strategic in reading and move from skills to strategies and back. It is important that teachers recognize their own reading skills and strategies, so they can teach their students how to read discipline-specific texts. Many of the literacy practices readers use can be called thinking processes.

Thinking Processes. People tend to use thinking processes—reading strategies or skills depending on automaticity—while trying to understand what they are learning. I have included these thinking processes as a way to analyze and label what the participants in this research did as they read self-chosen texts. Many of these thinking processes are considered higher-order

thinking skills, which can be found at the top three levels of Bloom's Taxonomy of Thinking Skills (Bloom, 1984). When I was working as a secondary literacy consultant for the Edmonton School Board (ESB), my colleagues identified thinking processes that secondary-discipline specialists could use to think and teach literacy skills to students. Brailsford and Stead (2009, 2010), Harvey and Goudvis (2007), Keene and Zimmermann (2007), and Bloom (1984) have all contributed to the categorization of ESB's list of thinking processes, which include: self-monitoring, analyzing, sequencing, making connections, predicting, inferring, applying, synthesizing, and evaluating. I added *applying* to their list. It is important to highlight that as a reader employs any one of these thinking processes; there is no distinct order in their use nor are these thinking processes used independently from each other. The following is a summary of each of these processes.

When **self-monitoring**, a reader is required to be mentally active and present as they read a text and set personal goals for comprehending the text (Brailsford & Stead, 2009, 2010; Harvey & Goudvis, 2007; Keene & Zimmermann, 2007; Shepherd & van de Sande, 2014; Chang, 2007). As they engage with the text, the reader sets personal purposes and asks questions to monitor their understanding. Goodman (1996) maintains that we all make mistakes or miscues when we read; they are part of the process of making sense of print. The reader needs to recognize when they are understanding and the comprehension is flowing smoothly, and when understanding has broken down and needs repairing. Once they understand there is a problem in comprehension, they need to apply appropriate strategies to correct understanding. Self-scaffolding (Monem, 2015; Kadri et al., 2017) is another helpful self-monitoring tool. Both private speech (Auleear Owodally, 2021; Lantolf et al., 2015) and mumble reading (Kragler 1995; Gilliam et al., 2011) are means of self-monitoring.

The second thinking process, **analyzing**, requires readers to concentrate on the literal information in texts (Brailsford & Stead, 2009, 2010; Harvey & Goudvis, 2007; Keene & Zimmermann, 2007; Dreyfus, 2002; Lawrence, 2007). They achieve this by pinpointing information from in-text features such as maps, graphs, cartoons, diagrams, illustrations, timetables, calendars, and charts. The reader also needs to retrieve central ideas and to support details stated explicitly by the author. Scanning is used to locate the necessary information. An analyzing reader provides evidence to check the reader's hypothesis, as well as to possibly confirm an inference or prediction.

To engage with **sequencing**, the reader needs to link information sequentially. For example, retelling a story (events, facts, arguments, details), following a math problem in a logical order, or giving or reading directions (Brailsford & Stead, 2009, 2010; Harvey & Goudvis, 2007; Keene & Zimmermann, 2007; Dreyfus, 2002). The reader needs to identify that the order of events, directions, or steps is significant. To recognize this significance, the reader must understand the text signals that indicate order such as “first,” “next,” “in relation to,” “on the other hand,” and other transitional devices.

The fourth thinking process is **making connections** (Ellery & Rosenboom, 2011). The reader needs to activate background knowledge and link the author's information to their own experiences and knowledge base (Brailsford & Stead, 2009, 2010; Harvey & Goudvis, 2007; Keene & Zimmermann, 2007; Ellery & Rosenboom, 2011). Texts, relationships, media, life experience—lived either first-hand or vicariously—are examples of their knowledge base and own experiences. The reader needs to compare information from two or more sources to make connections. In order to make connections, the reader needs to have background knowledge regarding the topics being read.

To engage in **predicting**, the fifth process, the reader needs to use hints from the text and consider what might happen (Brailsford & Stead, 2009, 2010; Harvey & Goudvis, 2007; Keene & Zimmermann, 2007; Coiro, 2011). Goodman (1996) maintains that predicting is part of the evidence that reading is an active process wherein the reader is continually predicting meaning based on what is already known about the text. The reader will link clues from the text to their personal experiences and background knowledge. As they read ahead in the text, the reader will either substantiate or amend their predictions.

Inferring, the sixth thinking process, requires the reader to fill in logical gaps left by the author (Brailsford & Stead, 2009, 2010; Harvey & Goudvis, 2007; Keene & Zimmermann, 2007; Walters, 2006). The reader must read between the lines and seek clues from the text and observations utilizing background knowledge and experience. There may be a need for the reader to visualize—not all readers have the capacity to visualize. Interpretation of maps, graphs, cartoons, diagrams, illustrations, timetables, calendars, charts, and other visual features is also required. The reader needs to go beyond the literal information and create logical sense from information not overtly specified.

The seventh thinking process is **applying**. Bloom (1984) explains application as the use of abstractions, particularly in concrete situations. The abstraction may be in the form of general ideas, rules of procedures, or generalized methods, including the application of technical principles, ideas, and theories (p. 205). Anderson and Krathwohl (2001) explain that when someone carries out or uses a procedure in a familiar or unfamiliar task, they are using the process of applying (p. 67).

The final two thinking processes require the highest order of thinking. For readers to use **synthesizing** as a thinking process, they have to activate background knowledge and retrieve

information (Brailsford & Stead, 2009, 2010; Harvey & Goudvis, 2007; Keene & Zimmermann, 2007; Dreyfus, 2002; Mateos et al., 2008). They then need to identify what is important without including too many details—that is, summarize—and understand ideas in new ways. Finally, **evaluating** requires the reader to identify whether the content is a reliable argument or biased (Brailsford & Stead, 2009, 2010; Harvey & Goudvis, 2007; Keene & Zimmermann, 2007; Methe & Hintze, 2003). Opinions are created from the content delivered, and the reader must be willing to confirm or adjust their thoughts as they read and learn the author’s views; this allows the reader to establish viewpoints and see events from different perspectives. The reader needs to be able to back up their opinions with evidence.

In order to use thinking processes successfully when reading difficult texts, readers need resiliency and perseverance. These two reading characteristics are developed through what Springer et al. (2015) call reading stamina and wide reading. Springer et al. define reading stamina as “the ability to maintain reading effort over time without support” (p. 304). Wide reading refers to reading a variety of texts that build background knowledge and vocabulary. Secondary discipline-specific texts are expected to get more complicated as students go through the grades. Post-secondary texts also are much more challenging because of the content, length, and complexity of the text. These researchers explain that if readers do not have reading stamina, difficult reading loads can create “frustration, anxiety, and discouragement in a beginning college student” (p. 304). Not having reading stamina can cause stress for anyone—no matter their age—if they have to read something for which they are not prepared. Not having the experience of reading a wide variety of texts can lead to a lower understanding of vocabulary and a lack of background knowledge.

Background Knowledge. Foundational to the use of thinking processes and disciplinary literacy is a reader's background knowledge. The information or life experience a person brings with them to help understand a situation or challenge is considered background knowledge.

Schallert (2002) refers to a person's information and life experiences as "abstracted residue" (p. 557). It is gathered consciously or unconsciously throughout a lifetime. Background knowledge may be one of the most important tools a reader has in order to understand and learn new information (Neuman et al., 2014; McVee et al., 2013; Marzano, 2004; Langer, 1984).

Background knowledge gives us hooks on which to hang new knowledge—to make connections with information already in our brains. This "abstracted residue" forms a bridge between the known and what is being learned about a subject or topic. That bridge makes learning more accessible and helps with remembering new information that goes into long-term memory.

Marzano (2004) points out the importance of background knowledge:

Although it is true that the extent to which students will learn this concept is dependent on factors such as the skill of the teacher, the interest of the student, and the complexity of the content, the research literature supports one compelling fact: what students *already know* about the content is one of the strongest indicators of how well they will learn new information relative to the content. (p.1)

Britton and Gülgöz (1991) explain that readers who have limited background knowledge have more difficulty understanding texts than readers who have considerable amounts of background knowledge, particularly when the reading necessitates substantial analytical cognition.

Readers use background knowledge to make connections with what they are reading. These connections are text-to-text (T-T), text-to-self (T-S), text-to-world (T-W), and text-within-text (T-within-T) (Ellery & Rosenboom, 2011). T-T means connecting what is being read to

information from previously read texts. When a reader makes connections to their experiences or responds vicariously to what is being read, that is considered T-S. T-W refers to connecting the text to what the reader has seen in the world via stories, television, websites, etc. Finally, T-within-T indicates connecting what is being read to information that was read earlier in the same text. These connections are imperative when making sense of any reading. If a reader is using background knowledge to make connections or to employ other literacy practices, it is beneficial that the reader has background knowledge in order to understand the text (Moje et al., 2010).

According to Goodman (1996), readers' background knowledge and experience can explain why individuals might glean different meanings from the same text. These various meanings may be different even from what the author intended. He also points out that readers sustain an individual, thoughtful, logical argument between new concepts and background knowledge. They then may alter inaccurate background knowledge based on the text or may discard new ideas from the text that are incompatible with their background knowledge. Regardless of what readers read, background knowledge is required for comprehension (Moje et al., 2010; Neuman et al., 2014; McVee et al., 2013; Marzano, 2004; Langer, 1984).

Chapter Summary

As I conducted my case study research on science, math, ELA, and SS teachers' interactions with texts, I used Vygotsky's (1978) ZPD, Gee's (2000, 2002, 2014) discourses and situated language, and Rosenblatt's (1982, 1988, 2013) transactional reading theory and reading stances. While I interviewed and had conversations with individual teacher participants, I was cognizant of what Warford (2011) dubbed the *ZPTD*. As I interacted with the participants, their subject-specific Discourses or nonvernacular social languages (Gee, 2014) needed to be at the forefront of the research. Rosenblatt's transactional reading theory and reading stances informed

the analysis of the data from the participants as they communicated how they engage with discipline-specific texts when they read. All three theorists—Vygotsky, Gee, and Rosenblatt—exemplify sociocultural theory, and their work offers the lens through which this research was viewed and analyzed.

The complexity of reading was the main focus of my research question. I used the knowledge of disciplinary literacy as I collected, analyzed, and interpreted my data. I also employed the discipline-specific literacy practices of Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014) as well as the participants' understanding of generic literacy practices in the interpretation of data. An understanding of TCK, metacognition, metalinguistic awareness, and automaticity of thinking was beneficial as I conducted, analyzed, and interpreted my research. The next chapter describes the methodology I employed in conducting my research.

Chapter Three: Research Methodology

Qualitative research involves an interpretative, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them. (Denzin & Lincoln, 2011)

The purpose of this qualitative inquiry was to explore the engagement of secondary-discipline specialists as they read discipline-specific texts. The motivation behind this was that I believed if teachers are cognizant about how they think as they read, they will have more awareness to communicate that thinking to students. According to Schwandt (2007), a methodology is “a theory of how inquiry should proceed” (p. 193). After considering a variety of research methods, a multiple case study approach was utilized to assist in the quest to answer my research questions and to uncover and understand how secondary-discipline specialists engage with discipline-specific texts.

In this chapter, I outline the research design for my study. The first section describes qualitative research and then focusses on the case study design and the participants in this study. The next section describes my data collection, including interviews, observations, documents, and think-aloud methodology. A description of the data analysis and interpretation follows. The last sections of this chapter include the researcher stance, delimitations, limitations, and ethical considerations.

Qualitative Research

Qualitative research involves several types of methodologies, including, but not limited to, narrative inquiry, action research, ethnography, phenomenology, and case study. Qualitative research gives researchers the freedom to explore a question deeply to gain in-depth information about the research question. This type of research is used in a variety of academic disciplines,

including anthropology, sociology, psychology, and education (Creswell, 2014). According to Denzin and Lincoln (1994; 2011), being situated within the world of the research, the inquirer can use a multi-method set of interpretive, naturalistic, and material practices that make the world of the research visible. Denzin and Lincoln (2011) also explain that the qualitative researcher conducts their investigation within its natural milieu, endeavouring to use the meanings people bring to the research to explain phenomena (p. 3).

Qualitative research helps researchers to gather knowledge and construct understanding of a question by using a methodology, design, or tool they need to build knowledge (Creswell, 2014; Stake, 1995, 2013; Yin, 2009, 2014). Schwandt (2007) noted that “human beings do not find or discover knowledge so much as construct or make it” (p. 38). Denzin and Lincoln (1994) explain that this methodological construction “involves the studied use and collections of a variety of empirical materials—case study, personal experience, introspective, life story, interview, observational, historical, interactional, and visual texts—that describe routine and problematic moments and meanings in individuals’ lives” (p. 2). The objective of qualitative research is to learn the thoughts and feelings behind the actions of the participants to appreciate and understand the participants’ actions and feelings (Ellis, 2009). For this undertaking to be successful, researchers need to examine the whole picture of the participants before specific or individual parts or experiences that they are researching (Ellis, 1998, 2009; Smith, 1991).

Qualitative research best suited the investigation of my research questions because it enabled me to study the participants and their experiences in a natural setting. It then allowed me to interpret the phenomena using the participants’ meanings. I used a multiple case study design to undertake my research inquiry.

Case Study Design

A case study is an exploration of a “bounded system” (Stake, 2008, pp. 119–120) or a case (or multiple cases) over time through detailed, in-depth data collection that involves multiple sources of information-rich context (Creswell, 1998, 2014). Researchers select case study design because of the nature of the research problem and the questions they ask. It is a means of investigating complex social issues with multiple important variables that are anchored in real-life situations, are useful in applied settings such as education, offer insights, and illuminate meaning. According to Creswell (1998), researchers choose case study to evaluate and conduct an “in-depth analysis of a case, often a program, event, process, or one or more individuals” (p. 14). Because it is possible to collect an overabundance of data, both Yin (2014) and Stake (2013, 1995) maintain that when conducting case study research, it is essential to set boundaries around the cases to keep the research from exploding with data.

Case study design helps to investigate a phenomenon within its situation by using a selection of data sources such as observations, interviews, and documents. Compared to other qualitative research methods, case study is considered more concrete, more contextual, and more developed by reader interpretations, and is based upon researcher-selected reference populations (Merriam, 1998). Merriam (2009) also explained, “the uniqueness of a case study lies not so much in the methods employed (although these are important) as in the questions asked and their relationship to the end product” (p. 44). Case study design ensures that researchers will discover and understand numerous sides of the phenomenon because they will not study the issue through only one lens, but through a variety of lenses, which will reveal and help to understand multiple facets of the phenomenon (Baxter & Jack, 2008). Merriam (1988) stated that descriptive case

study enables the researcher to “illustrate the complexities of a situation, ... show the influence of personalities, [and] ... include vivid material—quotations, interviews ... and so on” (p. 14).

According to Creswell (2014), as with every kind of research, potential weaknesses exist within case studies. For example, although they provide a detailed description desired, a researcher may not have the time or money to devote to such an understanding. Case studies can oversimplify or exaggerate a situation. Because just one researcher is doing the research, reliability, validity, and generalizability are also limitations that may possibly be found in case studies; a researcher’s sensitivity and integrity may limit them. According to Flyvbjerg (2011), “selection bias may overstate or understate relationships; weak understanding of occurrence in population of phenomena under study; and/or statistical significance often unknown or unclear” (p. 314). I kept these weaknesses in mind as I forged ahead, reminding myself that multiple case study design required that I needed to interact with the participants and collect the data with my eyes wide open.

In undertaking my research, I used what Yin (2014) called a *multiple case study approach* to focus on four cases. Single and multiple case studies are comparable in methodology in that they have similar data-gathering questions, units of analysis, reasons for connecting gathered data to the patterns that the researchers identify, and criteria for the interpretation of the findings (Yin, 2009, 2014). Merriam (1998) described a collective [multiple] case study as an “interpretation in context” that is precisely chosen because researchers are interested in insight, discovery, and interpretation rather than hypothesis testing” (pp. 28–29). Multiple case studies are considered to provide more convincing data than a singular case study and are therefore deemed more robust (Herriott & Firestone, 1983).

Research Participants

Like other qualitative research methods, case study research cannot take place without participants who willingly share their ideas, experiences, and work. I conducted this multiple case study with four secondary teacher participants who are specialists in a specific discipline—science (biology), SS, ELA, and math.

Participant Recruitment. Before finding participants, I needed to consider how to bound (Yin, 2014; Stake, 1995, 2013) my research, which was accomplished by having the participants meet the following research parameters: practicing secondary teachers who have a major or minor in one of the four subject disciplines; teachers who have been teaching their minor or major for at least ten years; readers of professional readings which inform their understanding of their subject areas, and; readers who are cognizant and able to talk about how they think as they read these texts. Each participant is a disciplinary expert in teaching and its Discourses or nonvernacular social language (Gee, 2014). Because of their education and experience, these teachers are familiar with the language that is necessary to understand and teach a discipline in a secondary school setting. It was an assumption that each of the participants had adequate reading proficiencies for their field.

Participants were recruited through contacts I made in my consulting position. It was imperative that participants be interested in my research questions and willing to be transparent about their ideas and work. Selecting teachers from different schools created opportunities to explore various perspectives in different settings. Contact with the teachers took place via phone calls and emails to determine their interest; then, appointments were set up to meet and discuss the research process. The participants were given an invitation letter and a consent form (see

Appendix B). Once the participants agreed to be a part of the research data and signed the consent form, the collection began.

Teacher Discipline Specialists. Within this section are descriptions of four teacher participants: Goodall, Elizabeth, Carmen, and Gosset (all pseudonyms). These teachers were chosen because they met specific research parameters. Interestingly, not only did each participant meet the research parameters, but they also had some other qualities in common. All were competent readers of a variety of different genres and texts. The pursuit of furthering their education and experience was also high on their priority lists. Goodall and Elizabeth both have Master of Education (MEd) degrees, Gosset was working on hers, and Carmen had the desire and ability to pursue one and had taken some MEd policy study courses. As well, Goodall and Elizabeth are employed in the same school.

Each participant will be introduced by providing information about teacher education, discipline specialty, teaching background, ideas about disciplinary literacy, and the context in which they teach.

Goodall—Science Teacher. Goodall, the science-discipline specialist and a self-proclaimed science geek, is an enthusiastic teacher, speculative learner, and passionate reader. Goodall's education and professional learning (PL) detail are essential in that they give depth to her background knowledge, love of learning, and growth as a professional. Part of this development includes a BEd from the University of Alberta's Campus St. Jean, where she minored in general science and majored in French. Her post-degree PL includes a Master of Religious Education from Newman Theological College, coursework on media literacy, participation in Teachers' Conventions, president of the provincial teachers' union local, and

participation in the provincial English Language Arts Council and Teachers' Association Science Council.

Goodall began her career teaching high school French and English language arts in a rural school. Throughout her career, Goodall has taught French. At the time of this research, she had been teaching science for 10 years in a French immersion Catholic school—Vichy School (pseudonym)—situated in a small western Canadian city. It is the province's largest single-track French Immersion Junior/Senior High School; it offers a fully bilingual program from Grades 7 through 12, dedicated to a Christ-centered learning approach. Goodall's teaching assignment for the 2016–2017 school year was 0.8 FTE Grade 7 Science and Grade 8 French Language Arts (FLA) and 0.2 FTE as the provincial teacher union's local president.

This participant's love for science, especially biology, is reflected in her choice of a pseudonym—Goodall—which was chosen because of the highly respected female biologist Jane Goodall. According to this participant, “even at the age of 86, Jane Goodall was advocating on behalf of animals and the larger context of the planet, which is just so amazing. She is a hero, an actual person because biology was my favourite subject by far.”

Elizabeth—Social Studies Teacher. One of the participants was the SS discipline specialist, Elizabeth, a passionate teacher, an inquisitive learner, and a thoughtful reader. Elizabeth's background knowledge played an essential role in her discipline reading. She has a degree in political science from the University of Ottawa with a minor in history, a BEd after-degree from Campus St. Jean University of Ottawa with a major in SS and a minor in French, and an MEd from the University of Alberta, examining online learning. As she was partaking in this research, she was learning Spanish because she was going to be teaching this language the following year. Elizabeth has taught SS for 13 years in Vichy School, the same school as

Goodall. Her teaching assignment for the 2016–2017 school year was SS 9, 20, 20 AP, and 30; FLA 20 and 30; Math 9; and curriculum coordinator.

When asked what pseudonym she wanted, Elizabeth, a self-proclaimed feminist, explained that she highly respected Elizabeth Warren. Before my research’s data collection, Elizabeth Warren had been asked to stop talking in the American House of Representatives but continued to speak and was chastised for it. Elizabeth—the participant—explained, “[Warren] continued anyway; nevertheless, she persisted. And so, “Nevertheless, she persisted.” became kind of like the hashtag for that movement of women who kind of are continuing with some female rights and women’s rights.”

Carmen—English Language Arts Teacher. The ELA teacher, Carmen, is an ardent teacher and lifelong learner who loves to read. Her background knowledge and experience were essential in understanding her reading of discipline-specific texts. She is a University of Alberta BEd graduate with a major in English and a minor in drama. She has taken a couple of MEd policy studies courses, writes fanfiction, and has a part-time job editing various types of writing such as novels and non-fiction texts. Carmen is an avid reader who was in a book club that was committed to reading 50 books a year, and throughout the data collection, sharing titles of previous and present books read. Some of these titles included: *Northanger Abbey* (Austen, 2000), *A Gentleman in Moscow* (Towles, 2016), *By Kitchens of the Great Midwest* (Stradal, 2015), and *The Last Days of Night* (Moore, 2016).

At the time of this study, Carmen had been teaching ELA for 10 years. Her teaching assignment was Grade 7 ELA and Grade 8 SS at Specialty Charter School (pseudonym), a K–9 charter school. Specialty Charter School is situated in a middle-sized western Canadian city. Along with Carmen’s teaching assignment, she ran the Grades 7 through 9 Euro trip. She had

been actively involved with her teachers' union by serving on the Economic Policy Committee. Carmen also served on the Teacher Board Liaison Committee.

Carmen is a passionate ELA teacher, and it is fitting that she chose the name of her Grade 8 and 10 English teacher—Carmen—as her pseudonym. Carmen explained how much she respected this teacher:

My Grade 8 and 9 English teacher is a great choice. She's a brilliant teacher, and she is incredibly intelligent, and she was really kind. ... She was incredibly organized ... had amazing classroom control ... I can count on one hand how many kids she sent to the office in the two years of being her student.

Carmen's passion for her discipline shadowed her pseudonym's namesake, who also reflected on her practice.

Gosset—Mathematics Teacher. Gosset—the math teacher—is a passionate teacher, a lifelong learner, and devoted to her discipline. As is the case with the other teacher participants, Gosset's background knowledge and experience are central to her understanding of the reading of her discipline-specific texts. She has a BEd from the University of Alberta with a major in mathematics and a minor in organic chemistry. She was working on a Master of Mathematics for Teachers (MMT) from the University of Waterloo and was taking the course titled History of Mathematics at the time of my data collection. Gosset also has a Newly Qualified Teacher Program (NQT) certification from the United Kingdom (UK) and has attended the AP Statistics Conference for new Statistics AP teachers.

At the time of this research, Gosset had been teaching math for nine years. Her years of teaching experience were one year less than the designated parameters for this research, but with her background, interest in the research, and the desire to grow in her understanding of

disciplinary literacy, she met the requirements of this research. She is not only pursuing an MEd in teaching mathematics, but she is also actively involved with PL within her school district, both to learn herself and to coach other teachers to effectively teach disciplinary-literacy skills to math, statistics, biology, and physics students. Gosset's teaching assignment was Math 30-1, Math 30-1 AP, and Stats 35 AP. The context in which Gosset teaches is Willow Park High School (pseudonym) in an average-sized western Canadian city.

At the beginning of our research journey together, Gosset viewed herself as a poor reader and was self-conscious about her reading ability. One of the reasons she wanted to participate in this research was to improve her reading and to become more cognizant of the reading strategies she uses so that she could teach them to her students. Even though she viewed herself as a weaker reader, she had an excellent ability to verbalize her reading engagement metacognition. By the end of the data collection, Gosset had gained more skills and awareness to navigate more confidently through difficult texts.

After some deliberation, Gosset chose, as her pseudonym, Gosset (for William Gosset, a Cambridge science graduate who specialized in statistics). Having a passion for statistics herself, Gosset explained that the Guinness Brewery was using a revolutionary method—small sample testing—to increase beer production and quality control by hiring “this brilliant, intelligent man to do all this extra statistical work.” Gosset was not allowed to publish his findings because Guinness did not want other brewers to use small sample testing, which Gosset perfected. This participant obviously admired her namesake-Gosset as a statistician.

All four of the discipline-specialist participants were passionate about their disciplines, as well as about learning and teaching. They all displayed inquisitiveness and perseverance in reading and were willing to go beyond the texts to learn. Their strong background knowledge

and ability to verbalize metalinguistic awareness were valuable assets to this research. When reading, each of the participants viewed their texts through a sociocultural lens; their background and experience influenced their comprehension.

Data Collection

Upon receiving ethics approval, I began to collect data for my multiple case study research. The data collection occurred over seven months; it ended once new data no longer sparked fresh ideas or concepts, or there was a saturation of information (Creswell, 2014). Creswell (2014) explains that, as the researcher, I was the key instrument in this inquiry process. As the key instrument in the data collection, I needed to be aware of what Bogdan and Beklin (2007) call the observer effect, that is, that my presence could change the behaviour of the people I am studying (p. 38). I recruited the participants at different times throughout the data collection period. I did not complete data collection with one participant before starting with the next; research periods often overlapped. The interviews and think alouds shifted as I learned from each interview and think aloud session.

Yin (2009, 2014) and Creswell (2014) identified six sources of evidence for case study data collection: interviews, direct observations, participant observation, documents, archival records, and physical artifacts. I used interviews, direct observations, and document collections, as well as a think-aloud protocol; all sources demonstrated the participants' own beliefs, thoughts, and capabilities regarding discipline-specific literacy.

Using these various means of data collection allowed for triangulation. Creswell (2014) views triangulation as an essential means of providing reliability to qualitative research, including case study (Yin, 2014; Stake, 1995, 2013). Bowen (2009) maintains that "triangulation helps the researcher guard against the accusation that a study's findings are simply an artifact of

a single method, a single source, or a single investigator's bias" (p. 28), which counters possible "threats to trustworthiness," such as reactivity, researcher bias, and respondent bias" (p. 38).

Sugirin (1999) notes that post-think-aloud discussions and follow-up interviews are valuable data collection methods that provide "reliability checks" that support "triangulation" (p. 2). In the next sections, I elaborate upon my data collection sources.

Interviews. The interviews were integral parts of my case study research. Weber (1986) and Brenner (2006) clarified that when researchers seek interviewees, they ask for their participation in a conversation, and the invitation must be sincere—one person inviting another person to discourse. Brenner (2006) commented that "the qualitative interview involves special considerations because of the personal relationship it often establishes with an informant and the sometimes-unpredictable direction that conversations can take as a project evolves" (p. 361). I found I had become quite attached to these four participants and needed to be cognizant of the personal relationships created by the interview process, not letting the relationship cloud the data analysis and interpretation.

Within the context of research, personal relationships are not the only advantages and disadvantages of interviews. According to Yin (2009) a possible benefit to interviews is that they are targeted at and focus directly on the case study topics; interviews have the potential to be insightful in that they reveal perceived causal inferences and explanations. Yin explains that the limitations of interviews include poorly expressed questions and responses that the participants believe the interviewer wants to hear, so I needed to be very clear in my questioning and sometimes had to restate questions in different words to clarify what I was asking.

Yin (2014) refers to the actual interactions and discussions that take place during data collection as a *verbal line of inquiry* (p. 241). Prior to beginning the first formal interviews, I sent

participants a list of preinterview activities (PIAs) (Ellis, Janji-Watrich, Macris, & Marynowski, 2011). As the participants answered and explained the PIA's, stories emerged that offered insights into the participants' experiences. These PIAs involved the topic under research or general life experiences or events. Sometimes when people talk about their lives in general, they reveal interesting insights into the research (Ellis, Amjad, & Deng, 2011; Ellis et al., 2013). PIAs allowed the participants to draw pictures, graphs, diagrams, and more. The PIAs offered to the participants are found in Appendix C.

I conducted two audio-recorded, in-person interviews with each participant. The first included the PIAs (see Appendix C), and open-ended interview questions (see Appendix D), which were split into four categories: Get to Know You, Professional Pathway, Disciplinary Literacy, and Teacher Own Reading Engagement, to glean the participants' understandings of two ideas: disciplinary literacy and their specific disciplinary-literacy practices. The second (post-think-aloud) follow-up interview followed my observations and recording of the participants' think alouds engaging in or reading at least four self-chosen texts. During this interview, I asked more open-ended questions (see Appendix E). If I required more clarification after the interviews, I sought further information via emails or during in-person conversations that occurred before or after the think-aloud sessions. Before think alouds, I would ask clarifying questions from prior think alouds.

Brenner (2006) explained that “unlike everyday conversation, the open-ended interview often begins with a big question and proceeds in what some have called the funnel shape—beginning with large questions, working down to details” (p. 362). The open-ended questions were written not to lead the participants, but rather to glean their ideas, experiences, and thoughts. Creswell (2014) suggests that interviews allow the participants to offer historical

information, and that the researcher controls the questioning. Questions asked for general information included, “In the world of nature, things, or people, what surprises you the most?” Other questions were more specific to the research question, such as, “What are some of your favourite literacy practices to support students’ literacy in your classroom? Can you tell me about one or two of these?” My questions evolved as I went through the data collection process and gathered insights from the participants in this research.

To focus my interactions with my four participants, I used the following opening data-collection questions:

- For the math teacher: How does a math teacher engage with reading math texts? What literacy practices do you need? What practices are specific to math?
- For the science (chemistry, biology, or physics) teacher: How does a science (chemistry, biology, or physics) teacher engage with reading science (chemistry, biology, or physics) texts? What literacy practices do you need? What practices are specific to science?
- For the ELA teacher: How does an ELA teacher engage with reading ELA texts? What literacy practices do you need? What practices are specific to ELA?
- For the SS teacher: How does a social studies teacher engage with reading social studies texts? What literacy practices do you need? What practices are specific to social studies?

I digitally recorded each interview. I also took notes in case a recording failed. Interviews often developed more questions that were answered before or after the participants’ think alouds. Oral language in the interviews revealed much about the participants (Weber, 1986); their word choice, tone, gestures, facial expressions, and volume reveal more about the language. The

interview transcriptions were completed at the earliest opportunity to capture the tone and information presented during the conversation. The transcripts were written in a Microsoft Word document in which the page was split into two columns, the first being two-thirds the width of the second. The first column was titled “Transcriptions” and the second was titled “Anecdotal Notes.” When transcribing the follow-up interviews, I split up the page similarly to the initial interviews, except the second column was entitled “Analysis.”

Observations. According to Creswell (2014), four advantages exist to using observations in qualitative research: 1) researchers have firsthand experience with participants; 2) researchers can record information as it occurs; 3) unusual aspects can be noticed during observations; and 4) exploring topics that may be uncomfortable for participants to discuss is another reason for using observations (p. 191).

Observations allowed me to watch and gain firsthand experience with the teachers. I conducted two types of observations. The first was a one-time observation of each teaching. For me to get a better understanding of each participant, specific observation of them teaching in their classrooms was beneficial. The primary purpose of these classroom observations was to get an idea of the context in which the teachers instructed in their disciplines, and to see how they implemented disciplinary literacy within their pedagogy. I recognized the time constraints, but I felt that direct observation would be beneficial to my understanding of the participants.

The other type of observation was watching the participants’ actions during interviews and think-aloud sessions. My think aloud observations allowed me to note any unusual factors (for example, use of certain literacy practices, including reading skills and strategies), as well as the thinking processes that teachers were unaware they used, and thus could not verbalize. The observations were also useful for exploring topics that the participants might ordinarily hesitate

to mention, such as revealing discipline-literacy beliefs they might not discuss openly, or might not even realize they held.

Because I presented observations from only my perspective, I ensured that if I had any questions regarding what I observed, I asked the participants after the observations. To make my presence as unobtrusive as possible, I built safe and caring relationships with the participants before the observations and was cognizant that the impact of my presence on the participants' behaviour would be inevitable. Thorough notes, photos, and audio recordings captured any elements I might have missed as I observed. I also wrote about my observations as quickly as possible after they occurred, to ensure that what I observed was fresh in my mind.

Documents. During the research process, I collected various documents. Creswell (2014) suggests that by gathering documents, the researcher can read them at any time, so the researcher saves time because the participants have written the information. Documents requested included the segments of the self-chosen texts and textbooks that teachers used and on which they wrote during the think-aloud readings, email correspondence, the field notes that I took during the observations and interviews, the interview transcriptions, and my journal reflections.

On a copy of each think-aloud text provided for me, I took notes, copied where they annotated, and wrote the approximate time at which they stated ideas. Recording the research allowed me to revisit my interactions with the participants. I transcribed the interviews and scanned the necessary data. Because my relationship with the participants continued throughout the research, I was able to contact them for clarification as needed.

Think-Aloud Methodology. The use of think aloud was a critical aspect of my data collection in that it allowed me to gather information on the participants' metacognitive

revelations. Before describing the think-aloud protocol used to collect data, I will give a description of think aloud.

Think Aloud. Think aloud is a strategy that reveals what a person thinks as they perform a task. This strategy can be used as a research tool as well as a teaching tool. When applying think aloud to research, Charters (2003) explains that even though think-aloud techniques in their existing structure have origins in cognitive psychology, to understand the relationship of thought and words it is useful to go back to Vygotsky's (2012) theory and its concept of "inner speech." Inner speech, according to Bodrova and Leong (2007), is completely "internal, nonaudible, and self-directed and retains some of the characteristics of external speech" (p. 69). When inner speech is utilized to talk to oneself, the person will hear the words but will not speak them aloud. Charters (2003) points out that Vygotsky's theory was "that the "inner speech" of verbalized adult thought processes develop from the "egocentric speech" of toddler monologues, also a form of "thinking aloud," with the goal of solving problems" (p. 69).

One of the problems with making "inner speech" external and verbalized is what Vygotsky (1987) called thinking that has been "folded." When reasoning becomes folded, a person thinks of many ideas simultaneously and may not be aware of all they are thinking at one time. Bodrova and Leong (2007) explain, "Although you may be aware of the final product, it takes a concerted mental effort to "unfold" or draw the ideas back into consciousness" (p. 70).

Charters (2003) also explains that Vygotsky's (2012) theory has an additional concept that entails the connection between abstract thought and inner speech. As people create and form mental networks, their thoughts become progressively more abstract, and words are only part of their intricate patterns of meaning. While it is necessary for language to be translated before thought can assume an understandable form, much of human thought is not kept in the brain in

words. According to Charters (2003), at the time of Vygotsky's life, the ideas of long-term and working memory, storage, and retrieval to explain concepts were not known; however, his conceptualizations are valuable to the possibilities of what think aloud can reveal.

When using think aloud as a research tool, all researchers should be mindful that think aloud, as it makes internal discourse external, cannot show deeper thinking in its entire intricacy. Charters (2003) explains that the deep-thinking processes have to be streamlined into words "before anyone, even the thinkers themselves, can really know them" (p. 70). The bottleneck of thoughts between the range of abstract thoughts and the restricted materialization of verbal thoughts slows down thought processes. Pressley and Afflerbach (1995) explain that researchers are not sure how the plethora of thoughts are changed before they are verbalized as "inner speech" that can be spoken out loud as a think aloud.

It is important to note that some researchers (Rankin, 1988; Cullum, 1998) view that think-aloud research fits well within case study methodology. Many researchers (Gilles, 2016; Cisco, 2016; Cheung, 2009; Shepherd & van de Sande, 2014; Shanahan et al., 2011) have used think-aloud protocol as a data collection method. As my research involved teacher engagement of texts, think aloud was a logical means by which to collect data. Similarly, Ebner's (2012) view is that think aloud has been found to be a beneficial way to gain insight into the processes involved in comprehending printed text (Pressley & Afflerbach, 1995). Olsen et al. (1984) explain that think aloud is a successful way of measuring higher-level thinking processes; it can also be used to study individual variations in completing the same task. Coiro and Dobler (2007) recognize think aloud's value for online understanding, which was significant because some my participants chose online articles as discipline-specific texts. Beers (2003) explained that think-aloud strategies help readers communicate the metacognition that is usually invisible and then

becomes visible. Participants orally communicated the connections they made, visualized ideas, and comprehended difficulties they confronted as well as ways to overcome them.

Jääskeläinen (2010) points out that when using think aloud as a means to collect data, “subjects are asked to perform a task and to verbalize whatever crosses their mind during the task performance” (p. 371). As the participants read texts, they analyzed and verbalized thinking. The thinking out loud allowed me to listen and watch for clues that revealed the teachers’ reading-engagement skills. Charters (2003) explains that it is not prudent to use think alouds as the sole source of data collection.

Research Using Think-Aloud Methodology. Various case studies have used think-aloud protocol methodology in some form to explore adult use and understanding of discipline-specific literacy. The following section highlights research that is significant to my discipline-specific literacy research focus. Relative to my study, all these case studies looked at the metalinguistic awareness of adult learners and their understanding and use of reading strategies.

Using descriptive case study, Gilles et al. (2016) followed a team of four middle school content-area educators as they revealed “their discipline-specific reading strategies and embedded the most useful ones in their classrooms” (p. 675). The goal of the research was to assist “discipline teachers [to] uncover the strategies they used as readers in their disciplines and then support them as they embedded useful strategies into their instruction” (p. 676). Participants read various texts and constructed understandings of their metacognition and strategy use. Besides field notes and classroom observations, these researchers used teacher-written think alouds and interviews of teachers and students for data collection. The think alouds were conducted using both researcher- and teacher-chosen texts. The findings of Gilles et al. suggest

that teachers took on an inquiry stance as they uncovered what discipline-specific strategies they used, and whether and/or how they would share it with their students.

Building on research in disciplinary literacy and content-area reading, Cisco (2016) conducted a multiple case study investigating the many stances of 13 undergraduate honors students chose when engaging with difficult texts while completing a Midwestern university's humanities course (p. 1). Results clarify how students cope with challenging texts from multiple disciplines within this course. By analyzing student interviews, writing, and observations, Cisco (2016) uncovered how these undergraduate honors students are identified by one of three stances when reading difficult works—*Bottom Liners*, *Researchers*, and *Feelers* (p. 1). According to Cisco (2016), *Bottom Liners* pursued the central meaning of a text, usually via online sources. *Researchers* endeavoured to alleviate their challenges by researching social, authorial, and historical contexts; *Feelers* strove to emotionally connect with the authors of the texts. Cisco (2016) used think-aloud strategies to model reading strategy use. Cisco's use of think aloud strategy to uncover thinking informed my use of think aloud as a data collection tool that allowed my participants to reveal their metalinguistic awareness.

Cheung (2009) conducted a multiple case study that, through interviews, employed think-aloud protocols to investigate 12 volunteer Hong Kong secondary school chemistry teachers' misconceptions about chemical equilibrium (p. 97). Cheung used the think-aloud method because research has shown it to be “an effective way to collect information about the cognitive processes that a person follows during problem solving” (p. 98). He also found that the use of the think-aloud method had been previously employed to explore problem-solving processes in science education. The think-aloud protocol provided evidence of the difficulty teachers experienced while attempting to solve the chemical equilibrium problem. Rather than making

purely computational errors, the teachers failed to solve the problem because of misconceptions they held; that is, one can always cause a reversible reaction to shift to the right by increasing the concentration of a reactant. Cheung concluded that teacher misconceptions are “due to an over-emphasis of the ‘change-then-minimize’ logic of Le Châtelier’s principle in our school chemistry curriculum and textbooks” (p. 106).

A case study by Fang and Chapman (2020) explored one mathematician’s reading practices focusing on the strategies used in his comprehension of text. The mathematician’s think alouds during reading, discussion of his reading think alouds, and semi-structured interviews were used in data collection. Data analysis was an iterative process comprising several “readings and identification and refinement of codes” (p. 1). Fang and Chapman’s analysis revealed that for the mathematician to understand the texts, he “engaged in extensive reading and employed an array of strategies—rereading, close reading, monitoring and questioning, summarizing and paraphrasing, storying, drawing on prior knowledge and experience, evaluating and verifying, and note-taking and visualizing” (p. 1). The think aloud used in this case study allowed the researchers to collect data that represents what a mathematician thinks while reading.

The case study that influenced my research most significantly was that of Shanahan et al. (2011), in which they researched expert readers in three disciplines—history, mathematics, and chemistry. Their goal of this study was to get data that would support and improve disciplinary literacy instruction in high school. These researchers used “think-aloud protocols, transcripts from focus group discussions, a recursive process of member checking, and a cross-disciplinary consideration of reading approaches identified in each discipline [to identify] important differences in the reading behaviors of the six disciplinary experts” (p. 393). The use by Shanahan et al. of think-aloud protocol and their study of the reading ability of discipline

specialists helped focus my methodology. Like Shanahan et al., I wanted to get better insight into how discipline specialists engage with texts, so I could gather information to assist with the teaching of secondary disciplinary instruction. Instead of selecting professor participants, I chose secondary teacher discipline experts.

Think-Aloud Protocol. I developed a think-aloud protocol by having five teacher friends help me experiment with how to get the research participants to explain their thinking effectively. I was able to fine-tune my think-aloud protocol by practicing my explanation of think aloud and my observation and interaction with the readers. My teacher friends read a couple of self-chosen texts during recorded sessions. Pressley and Afflerbach (1995) and Ericsson and Simon (1993) recommend having a think-aloud protocol that gives sufficient direction for the task while leaving the process open-ended enough for participants to experience freedom of thought. From researching other think-aloud processes (Ebner, 2012; Perkins, 1981; Pressley & Afflerbach, 1995; Shanahan et al., 2011) and exploring my own procedure, I moulded a think-aloud protocol (see Appendix F). This think-aloud process was given and explained to the participants before their first think alouds. I read it through with them just before their initial think aloud and reminded them of this protocol before the second to fifth or sixth think alouds. I also provided think-aloud hints (see Appendix F). The protocol was flexible in that the participants could change the order or flow, depending on the text.

Teacher participants engaged in a think aloud as they read one three-to-five-page, discipline-specific text chosen by me and at least four comparable self-chosen texts. Appendix G contains names and a short summary of all the texts used by participants. The five to six think-aloud sessions for each participant occurred over a four- to seven-week period, depending on participants' availability. I was present during all of the audio-recorded readings. To have my

participants reveal their thinking, I needed to ask them more pointed questions at different times throughout the data collection; I asked questions before or after think alouds to clarify what the participants had revealed during think alouds. Yin (2014) emphasizes that case study researchers “require an inquiring mind *during* data collection not just before or after the activity” (p. 73). According to Yin (2014), “the ability to pose and ask good questions is therefore a prerequisite for case study researchers” (p. 73). For example, during data collection, after one or two think alouds, I wondered why participants were not addressing the use of visualization or an understanding of text structure or organization. Research suggests that many but not all readers visualize (Mackey, 2019), so I was curious as to whether they used this strategy.

During the think-aloud data collection period, as the first couple of participants completed their second think alouds, I noticed they were repeating the same literacy practices they had mentioned in the first think aloud. I became curious as to whether they had used other literacy practices but just had not articulated them. I decided to ask the participants specific questions about their use of these as a part of their reading practice. It turned out that all four participants had used visualization at different levels, but would not have thought about expressing its use. The same held true for their understanding of text structure and organization. In asking more direct questions of their thinking, I collected crucial data. They became more aware of their underlying or automatized thinking and were able to communicate this metalinguistic awareness. The challenge was to make their implicit thinking explicit or the unconscious, conscious (Cleeremans et al, 2020). If I had not asked specific questions about their thinking, certain reading practices may not have been captured; the data could have lacked the depth uncovered by my probing questions. Yin (2014) and Becker (2008) support the

employment of probing questions that change throughout the data collection period, to make up for the lack of evidence gleaned from unquestioned data collection.

I used the data recorded from these think alouds in later interviews, to give participants an opportunity to reflect and elaborate. Their subsequent reflections and elaborations proved to be illuminating. I collected copies of the texts so I could write notes on them as participants read. Using a think-aloud strategy, participants explained how they had navigated and comprehended the text. Using this metacognitive strategy shortened the data collection time because participants engaged with the texts for a limited time, depending on the length of the texts. Right after each think aloud, we discussed the process each participant went through to clarify their thinking. Appendix H contains an example of a portion of a think-aloud transcription.

I provided scaffolding (Warford, 2011; Benko, 2012; Bonk & Kim, 1998; Brown, 2007; Fournier & Graves, 2002) for the participants by giving them the choice of think-aloud texts. This choice helped ensure that participants selected texts that would most likely reflect their reading ability.

Following each think aloud, I spent some time debriefing the participants about what they had demonstrated and verbalized. During these clarifying debriefing sessions I asked questions regarding reading strategy use. I did not interrupt think alouds to highlight literacy practices not verbalized. As experienced by Shanahan et al. (2011), my discussions with participants, along with their responses and perceptions, helped them verbalize their reading engagement. This heightened articulation helped me determine the implications of the reading behaviours that were observed or identified as missing.

After listening to and transcribing think-aloud sessions, I noticed that the participants did not use the *nonvernacular social language* (Gee, 2014, p. 23) that would describe their literacy

practice use. When I met with the teachers for their next think aloud or for their follow-up interview, I reflected their thinking back to them by giving them the terms that could describe their thinking. Like Cheung (2009), I endeavoured to give hints or reinforcement to participant thinking (p. 99). The degree of reinforcement varied with each of the teachers, depending upon their facility with communicating *nonvernacular social language* (Gee, 2014). As it turned out, my reflection of their thinking back to them did not heavily impact their awareness of their literacy practice use.

As the initial and follow-up interviews needed to be transcribed, so did the recordings of each participant's think aloud as they read discipline-specific texts. Using Microsoft Word dual-panel documents, two-thirds of the page went to transcription and I used the last third for analysis. I used codes similar to the ones used for interviews.

Data Analysis and Interpretation

In qualitative research, data is analyzed to interpret themes. According to Bogdan and Biklen (2007), analysis entails six aspects: working with data; organizing data; breaking data down into manageable units; coding data; synthesizing data; and searching for patterns (p. 159). Ely et al. (1997) maintain that the examination of data for themes is “one of the most frequently mentioned analytic approaches used by qualitative researchers” (p. 205). Bogdan and Biklen (2007) explain that “data interpretation refers to developing ideas about your findings and relating them to the literature and to broader concerns and concepts” (p. 159).

Throughout my research, as supported by Schwandt (2007), the data collection, analysis, and interpretation were recursive. My data collection and my understanding of what the data was teaching me changed, which corresponds with the emergent characteristic of qualitative research (Creswell, 2014). My questions for the participants evolved as the process continued. According

to Creswell (2014), I needed to be conscious of exploring the meanings that participants revealed during the research process, rather than what I contributed or what the literature has revealed. I needed to be consistently cognizant that I was hearing and seeing what the participants knew about disciplinary literacy and how they engaged with discipline-specific texts. Researchers need to put the transcript of an interview into the context of the whole interview.

In accordance with Charter (2003), as I was analyzing and interpreting the think alouds, I needed to make some inferences, because to ask clarifying questions during the think-aloud activity would have disrupted the organic flow of the participants' internal thoughts.

As Creswell (2014) asserts, in qualitative research, the data collection and data analysis coincide. I used both inductive and deductive data analyses (Ely et al., 1997; Creswell, 2014; Bogdan & Biklen, 2007) to look for patterns, categories, and themes. Even as I was transcribing the interviews and think alouds, I began the analysis and interpretation. Ely et al. (1997) explain that "interpretation means drawing meanings from the analyzed data and attempting to see these in some larger context" (p. 160). The anecdotal notes/analysis column of the interviews and think-aloud transcriptions gave me space to write down observations and preliminary analyses of what the participants said. For example, I noted an interesting quote I might want to reference or use later, or I recognized links to literacy theories. As I transcribed more of the interviews, I became more skilled at the preliminary analysis. For example, after transcribing the first two interviews (science and SS), when I transcribed the ELA interview, in the "Transcription" column I was able to highlight actual reading strategies that Carmen stated she used while she read. For the initial math interview transcription, I was able to highlight in the "Anecdotal Notes" column that Gosset was using and teaching self-monitoring skills. For both the initial or

pre-think-aloud interviews and the follow-up interviews, I generated tables with the questions in the left column and each participant's data in a designated column.

In the follow-up interviews, because I was more familiar with the participants, I was better able to recognize what information was noteworthy and what was not. For example, Goodall explained her “ah-ha” moments, such as when she recognized her reliance on the English teachers to teach the reading skills, she thought her science students needed to understand their science texts.

As I analyzed each interview and think-aloud observation, more questions surfaced. Once I had conducted the interviews and completed the transcriptions, I reexamined the data several times with the research questions in mind. I formatted my transcriptions on a split page, leaving one-third of the page blank for notes, comments, and/or analysis about the data from the transcripts. I reexamined the transcriptions for different purposes. I looked for and bolded or highlighted specific literacy practices as well as various reading theories, including Rosenblatt's (2013) transactional theory.

Coding. As encouraged by various qualitative researchers (Ely et al., 1997; Creswell, 2014; Bogdan & Biklen, 2007), in determining themes I employed codes and a coding system—hand coding—to search for, organize, and sort textual information to identify themes. Hand coding entailed highlighting similar data by using the same-coloured highlights, fonts and/or bolding, and numbers and letters to keep track of similar content. In addition, I bolded and/or colour-coded the transcription text that demonstrated the code, and placed the code in the analysis column. Code identification took place using Rosenblatt's (1982, 1988, 2013) transactional theory, including efferent and aesthetic stances, as well as Gee's (2000, 2002, 2014) nonvernacular social languages, which, for this study, included literacy practices such as

thinking processes and various literacy-specific reading characteristics (Lent, 2016; Shanahan and Shanahan, 2008, 2012; & Shepherd and van de Sande, 2014). Table 2 contains examples of the analysis codes (the colours of the codes are in parentheses) used to determine the demonstration of transactional theory and reader efferent and aesthetic stances.

Table 2

Analysis Codes

Discipline	Efferent Stance	Aesthetic Stance	Transactional Theory
Science	ES-SCI	AS-SCI (red)	TT-SCI (light blue)
SS	ES-SS	AS-SS (green)	TT-SS (blue)
ELA	ES-ELA	AS-ELA (purple)	TT-ELA (dark blue)
Mathematics	ES-MA	AS-MA (pink)	TT-MA (lilac)

As I completed and read the transcriptions, many reading skills, strategies and thinking processes were demonstrated. Evidence of nonvernacular social languages was bolded in the text, and the reading strategy name was placed in the analysis column. See Appendix I for an example of a portion of an analyzed transcription.

My analysis involved superficial examination (skimming), more thorough examination (reading), and interpretation. This repetitive process used thematic analysis. Bowen (2009) explains that “thematic analysis is a form of pattern recognition within the data, with emerging themes becoming the categories for analysis” (p. 32). During my first data examination, I identified content pertinent to my research by determining whether the data answered my

research questions. Then, to search for common themes, I carefully reread and reviewed the data as many times as necessary to reinterpret and reexamine them until no other themes emerged (Ellis, 1998).

As I interpreted the data, I kept in mind the literature and theories that comprised my study's theoretical and conceptual frameworks (Rosenblatt, 1982, 1988, 2013; Gee, 2000, 2002, 2014; Vygotsky, 1978). Ely et al. (1997) point out that "understanding of theory and the uses of 'theory talk' (Daniell, 1994) are important to qualitative research writing" (p. 225). Bogdan and Beklin (2007) explain, "Good researchers are aware of their theoretical base and use it to help collect and analyze data. Theory helps data cohere and enables research to go beyond aimless, unsystematic piling of accounts" (p. 24). I searched for Discourses (Gee, 2000, 2002) or nonvernacular social languages (Gee, 2014) that revealed the kind of language and thinking that the secondary discipline specialists use and expect from students, as well as the participants' beliefs about literacy within their subject areas. I created charts containing data that reflected Rosenblatt's (1982, 1988, 2013) stances and transactional theory and Gee's (2000, 2002, 2014) Discourses, including the various literacy practices used.

Based on the data's characteristics, I used coding and constructed categories to uncover reoccurring themes. I also continually reflected on the data throughout the analysis. I listed the reading skills and strategies, thinking processes, and connections to the literature and theory. Once each think aloud was transcribed and analyzed, the literacy practices used by the participants were coded and organized. Initial codes (Charmaz, 2006; Glaser, 1978) are demonstrated in a table (see Appendix J) that shows the literacy practices used by each participant for each think aloud. There are four columns, one for each subject/participant. In each column, literacy practices are given; the think aloud number where the literacy practice was

demonstrated follows in parenthesis. For example, under the Goodall Science column, the first literacy practice is paraphrasing, and Goodall showed evidence of this in think alouds I, II, V, and VI.

To deal with the surfeit of data, I made an in-depth analysis of each participant's most difficult text. More focused codes (Charmaz, 2006; Glaser, 1978) were created to demonstrate discipline specific literacy. I labelled the literacy practices used by each participant and then moved the quotes—evidence of the literacy practice used—into a Word document. Appendix K contains the literacy practices Carmen employed (shown in bold print) while reading her most difficult text (Rushdie, 2008), as well as her quotes demonstrating the literacy practice use.

As I examined the data, I recognized that the participants used more literacy practices—the reading skills and strategies—than they had stated during the initial interview. Appendix L contains focused codes with examples of comparisons and contrasts of the reading skills and strategies used by Goodall (first table) and Elizabeth (second table). Column 1 reveals the pre-think-aloud reading skills and strategies that the participants stated they had used. Column 2 comprises the reading skills and strategies that the participants demonstrated while reading their most difficult texts. Column 3 shows the reading skills and strategies used during the difficult text think aloud, but not verbalized during the pre-think-aloud interview.

Using focused codes, I also analyzed what the participants voiced in the first interview regarding their literacy practice use and what they demonstrated during their think alouds. Appendix M contains a table that demonstrates Goodall's understanding of her literacy practice use in the initial pre-think-aloud interview (Column 1), in comparison to what she demonstrated during the think aloud of her most difficult text (Column 2) (Lin et al., 2017). Literacy practices stated in the interview and then used in the think aloud were circled in Column 1, and then an

arrow was drawn from that literacy practice to the corresponding literacy practice in Column 2. For example, in the pre-think-aloud interview, Goodall stated that she would “break words apart or use a dictionary to find unknown words,” which she demonstrated by finding meanings of difficult words using the dictionary, Wikipedia, context clues, prefix, suffix, and root clues. Any literacy practice not demonstrated during the think aloud was highlighted in yellow in the first column. Literacy practices that were used during the think aloud but not voiced in the initial interview, such as skipping or making predictions, had an arrow pointing away from it. The boxes around literacy practices in the second column refer to literacy practices that were used by one or more of the other participants while reading their most difficult texts.

As well, using focused codes, I determined whether my study participants were reading as discipline specialists, according to Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande’s (2014) characteristics of discipline-specific text reading. Accordingly, I made charts of the reading strategies and skills and thinking processes that each participant used, and then correlated them to the literacy characteristics (Lent, 2016); Shanahan & Shanahan, 2008, 2012; Shepherd & van de Sande, 2014). Once I had examples of the participants’ metalinguistic awareness via think alouds, I was able to find examples of their reading as discipline specialists. To keep track of the discipline-specific literacy practices, I made discipline-specific lists from Lent (2016) and Shanahan and Shanahan’s (2008, 2012) literacy characteristics. For math, I included Shepherd and van de Sande’s (2014) reading strategies. Appendix N contains Elizabeth’s (SS) list. While I looked at Elizabeth’s most difficult reading think-aloud transcript (see Appendix O), I checked literacy characteristics on the list (see Appendix N). I numbered the examples that demonstrated the literacy practice on the transcript, and then placed that number on the list (see Appendix O).

The focused codes led to theoretical codes (Glaser & Holton, 2005) based on transactional theory (Rosenblatt, 2013), nonvernacular social languages (Gee, 2014), automaticity of thinking (Rawson, 2010; Bodrova & Leong, 2007), and both content-based literacy and discipline-specific literacy.

Themes. Through my data analysis and interpretation processes, themes were revealed. This was a time-consuming process of investigating and considering several theories and ideas as I examined the data. Bogdan and Beklin (2007) explain that “interpretation involves explaining and framing ideas in relation to theory, other scholarship, and action, as well as showing why your findings are important and making them understandable” (p. 159). Analysis of emerging themes for this multiple case study was directed by relying on theoretical propositions (Creswell, 2014), which were: transactional theory (Rosenblatt, 2013); the conceptual frameworks of content-based literacy and discipline-specific literacy; nonvernacular social languages (Gee, 2014); and automaticity of thinking (Rawson, 2010; Bodrova & Leong, 2007).

Throughout the data analysis and interpretation, various content-based literacy skills and strategies were highlighted. To focus the data interpretation, discipline-specific literacy was analyzed. The participants’ content-based and disciplinary literacy reading engagement uses relate to Gee’s (2014) nonvernacular social languages. For the participants to verbalize their metalinguistic awareness, they needed to possess the language with which to communicate it. The data revealed that the participants did not always verbalize their use of specific vocabulary while engaging with texts. The automaticity of the participants’ thinking (Godde et al, 2020; Rawson, 2010; Kuhn et al., 2010; Bodrova & Leong, 2007) is connected to their non-verbalization of reading Discourses. Their reading ability had become so automatic that the

literacy practices they used had become implicit. They sometimes did not make the implicit, explicit.

In Chapter Five, I discuss three major themes revealed through data analysis and interpretation: (a) literacy practices—reading skills, strategies, and thinking processes; (b) cognizance of literacy practice use; and (c) reading as discipline specialists. As Creswell (2014) recommends, I produced a holistic account of the data and created a complex representation of the problem I had researched.

Researcher Stance

An important component of qualitative research is the researcher's reflexivity. Creswell (2014) stated that "the inquirer reflects about how their role in the study of the personal background, culture, and experiences hold[s] potential for shaping their interpretations, such as themes they advance, and the meaning ascribed to the data" (p. 186). According to Atkins and Wallace (2012), positionality entails particular regard and explanation of the relationship between one or more of the researcher's values, practices, assumptions, interests, experiences, and choices, and the research practice. It is important for the researcher to be aware of their positionality; in addition, the audience must recognize that the researcher took positionality into account (Corlett & Mavin, 2018). My expertise as a teacher and my understanding of discipline-specific literacy practices also influenced my view on and observations of my research. As a researcher, I developed and changed as what I heard, observed, and analyzed influenced me. I was also vigilant in my use of concise language that represented the participants' ideas, views, and activities.

Bias is an inevitable aspect of qualitative research, and I was consistently aware of my own biases to ensure the reliability and precision of the documents. I was cognizant of my biases

as I interviewed, observed, collected, and analyzed the data. Some of my biases include my passion for teaching and for teaching discipline-specific literacy practices; my teaching experience, which includes a majority of teaching junior high ELA with an emphasis on Grades 8 and 9 as well as some SS 7, 8, and 9, making my understanding of other subjects limited; my idea that teachers of SS, math, and science (chemistry, biology, or physics) might not have the same drive, orientation, and/or background as ELA teachers to ensure that students understand the discipline texts; and my thinking that teachers who have a strong background in their subjects are the most effective in teaching those subjects. Understanding my biases allowed me to be cognizant of what Creswell (2014) states about how researchers keep “a focus on learning the meaning that the participants hold about the problem or issue, not the meaning that the researchers bring to the research or what the writers express in the literature” (p. 186). Bowen (2009) explains that “the triangulation of data sources ... in effect, countered threats to trustworthiness, such as reactivity, researcher bias, and respondent bias” (p. 38).

According to Levi-Strauss (1972), a qualitative researcher is a “Jack of all trades or a kind of professional do-it-yourself [person]” (p. 17), or a *bricoleur*, who collects data from a variety of documents or resources, or *bricolage*, and analyzes the data. The ability to do this requires that the *bricoleur* multitask to collect information from a wide variety of documents, recordings, and observations, and even create new tools to further the research and construct an understanding. In this construction, the *bricoleur* must be cognizant of the fact this is a collaborative process that both their background—including social status and class, gender, personal history, race, ethnicity—and the backgrounds of the study participants are part of the research process (p. 4). The *bricoleur*'s text is a dense, reflexive, complex creation that

represents the researcher's understandings and interpretations of the world and the phenomenon under study (Denzin & Lincoln, 1994, 2011).

As I conducted my research, I remained aware of my responsibility as a researcher to consider the *bricolage* that constitutes qualitative research. I consistently watched and learned to ensure my ideas, biases, and the literature on which I relied did not cloud the participants' revelations. Knowing my ideas and the content of the literature helped me take a more objective perspective on what the research participants verbalized, wrote, or did.

Delimitations

I delimited the research to four teachers in their classrooms, whom I both interviewed and observed. Because my math teacher participant data collection continued into the summer, I observed the math teacher's last two think alouds and conducted the follow-up interview at her home. For the research method I chose, these locations were the most suitable to best answer the research questions. I gleaned the teachers' understandings and practices most effectively in one-on-one interviews and observations of the engagement of reading as they implemented think aloud.

Limitations

Because of the small sample size of four discipline-specialist secondary teachers, my discoveries from the research are not directly generalizable to all teachers or students in all classrooms. My roles as both participant and observer affected and shaped the data gathered and analyzed. My research primarily emphasized two factors: the analysis of the information gathered from participants, and my observation of the participants' reading, interviewing, and teaching activities. According to Creswell (2014), one of the limitations of case study research related to participants is that the information gathered is indirect and sifted through the

participants' views, and not all participants are equally expressive or insightful—a fact of which I was aware throughout the data collection.

The use of think aloud as a research tool has its limitations. The goal of think aloud is for participants to verbalize their thinking. According to Charters (2003), three concerns arise in using think aloud as a research tool. First, only verbalized information is noticed. Second, thoughts or information at the forefront of the participants' minds have limited capacity; these thoughts are held in mind only momentarily and can fade away as soon as new thoughts replace them. Consequently, oral accounts that occur only immediately following the production of a thought can be considered to reveal conscious thought correctly. I had to concentrate on the participants' prompt recognition, rather than on delayed explanations of their thinking.

The third concern about using think aloud in research is that many thought processes occur that the participants will not verbalize. This lack of oral communication could occur because the thoughts are automatic or because the participants' transitional thinking occurs so quickly that there is no time to verbalize it. I could use only the information that was orally communicated through the think alouds.

Ethical Considerations

Important ethical considerations govern the protection of researchers and participants. I attained ethics approval from the Research Ethics Board at the University of Alberta's Faculty of Education and from the school districts in which I conducted my study. Before beginning my research, I sent the teachers information letters and consent forms, and asked for permission to tape the interviews and take notes during classroom observations. These forms advised them of the purpose of the study, assured them of anonymity and confidentiality, and provided the opportunity for voluntary and informed consent/assent.

Before I conducted my first official interviews, I contacted the participants and met with them at their schools to explain my research and the difference between content-based literacy and disciplinary literacy. I assured them that participation in the research was not an evaluative process, and that I was aware there might be things they would not want a researcher to document and later write about. Participants were advised that if there was anything they did not want included in the research, they needed to communicate that.

I set times for our first interviews and informed them that, with their permission, our conversations would be recorded. I explained that I would assign pseudonyms of their choice to ensure anonymity throughout the data collection, analysis, interpretation, thesis writing, and publication.

An element of trust is essential between researchers and participants. By agreeing to become participants, the teachers demonstrated the hope and trust that I would use what they said for good and not for betrayal. I also advised participants that they could withdraw from the study at any time without penalty or prejudice.

Chapter Summary

Creswell (2014) points out that “research approaches are plans and the procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation” (p. 3). In this chapter, I have explained my approach to the research I conducted as I answered my research question: How do secondary discipline specialists engage with discipline-specific texts? This explanation mapped out my case study qualitative research methodology. In the next chapter, I will present excerpts from the interviews and think alouds that demonstrate the various aspects of the four participants’ reading engagement as well as their pre- and post-think-aloud views on literacy practice use and disciplinary literacy understanding.

Chapter Four: Presentation of the Data

In every case, it is the reader who reads the sense, it is the reader who grants or recognizes in an object, place, or event a certain possible readability; it is the reader who must attribute meaning in a system of signs, and then decipher it. We all read ourselves and the world around us in order to glimpse what and where we are. We read to understand, or to begin to understand. (Manguel, 1996, p. 7)

Chapter Overview

Reading is a sociocultural event (Rosenblatt, 1978; Street, 2006; Vygotsky, 1978; Gee, 2002) in which a reader understands a text by attributing “meaning in a system of signs and then decipher[ing] it” (Manguel, 1996, p. 7). Throughout this chapter, the four participants’ voices will be featured, demonstrating how they engage with discipline-specific texts. The participants revealed their thoughts through the following: (a) participation in the pre and post interviews, (b) think-aloud metacognition shown as they engaged with the most difficult of their self-chosen texts, (c) their thoughts about the text I chose, (d) my observations of what they did during the think alouds, and (e) discussions that were had before and after the think alouds. To interact with and comprehend texts, it was necessary for participants to engage in various literacy practices, including reading skills, strategies, and thinking processes (nonvernacular social languages). Through the articulation of their thoughts, I was able to determine the literacy practices employed; these are highlighted throughout this chapter.

This chapter has nine main sections. The first is an exploration of the participants’ preliminary understanding of the reading strategies they use while reading discipline-specific texts. Second is an elucidation of the participants’ reading purposes for all the texts chosen by the participants. The third is a demonstration of the participants’ use of transactional theory. Fourth is a revelation of the participants’ uses of literacy practices, including reading skills, strategies, and thinking processes, as they read their most difficult discipline-specific texts. The

fifth section is a demonstration of the difference between the participants' cognizance of literacy practices and their actual use. Sixth is a revelation of the participants' thoughts regarding the text I chose for all of them to read, which was the last of their think alouds. The seventh section is a description of the participants' post-think-aloud understanding of the reading strategies used while reading discipline-specific texts. The eighth section is a demonstration of the growth of the participants' understanding of disciplinary literacy throughout this research journey. The ninth and final section is an uncovering of the participants' acknowledgment that they would like to change some of their pedagogy because of their involvement in this study.

I begin by clarifying my use of the terms "reading skills" and "reading strategies," which fall under the umbrella of literacy practices. At many times throughout the participants' think alouds, they used literacy practices like reading strategies and thinking processes (nonvernacular social languages) that had become skills. Skills are strategies and thinking processes that have become automatic. I highlight them as ways of reading that need to be emphasized in discipline-specific classrooms.

Each participant had the choice to pick four to five discipline-specific texts, so they would have ownership of what they read and so the texts would be at the appropriate reading level. The last text they read was my choice. Appendix G contains a table that gives a brief description of the texts the participants chose for each think aloud. The text choices indicate the types of readings chosen by participants, which gives a glimpse into the participants' reading levels and interests. Most of the texts come from paper journals or textbooks while others come from electronic journals and websites, demonstrating the change to more multimodal texts (Kress, 2010). To assist with data collection, the electronic texts were printed. The SS teacher explained to navigate websites she would Google a topic and then find the most appropriate

website. Once she got to the website, she will read it as well as follow the links that would take her to many other sites. This demonstrated her New Literacies reading strategies (Leu et al., 2013).

Depending on their disciplines, each participant read various texts that incorporated the alphabet and/or ideographs. They all had basic reading skills but required strong background knowledge in their discipline, as well as a variety of literacy practices, including reading skills and strategies that enabled them to understand their self-chosen texts. To successfully comprehend texts, each participant was required to use specific reading skills and strategies depending on the discipline, purpose, and text. An important part of my research was being able to recognize the various reading skills and strategies the participants used.

Preliminary Understanding of Discipline-Specific Literacy Practices

Before discussing the participants' literacy practices used during data collection, I give a description of their understanding of literacy practice implementation, as explained in the preliminary interviews. During these interviews, participants were asked what literacy practices—reading skills, strategies, and thinking processes—they used when they read discipline-specific texts. These literacy practices are the nonvernacular social languages (Gee, 2014) used to understand texts. Table 3 contains a summary of their responses. Each participant was able to identify several strategies they used to read discipline-specific texts. From this table, I highlight two aspects of their literacy practice use. The first is that several of the strategies were used by two or three of the participants, but sometimes they identified the strategy differently. For example, Elizabeth explained visualization as forming images in her mind of what is being read; those images fill in the gaps in her understanding of the information. Gosset, on the other hand, used the strategy terminology “visualization.” The second notable aspect is that no one

strategy was used by all four participants. The literacy practices have been organized with the common ones first (even if they are named differently), followed by each participants' unique practices. Table 3 also shows that Carmen verbalized the fewest literacy practices, whereas Gosset was aware of the most. Additionally, Gosset was the participant who expressed the greatest number of unique practices. During the think alouds the participants implemented the use of many more practices, as indicated in Table 4 (page 199).

Table 3

Participants' Preliminary Interviews—List of Discipline-Specific Text Nonvernacular Social Languages

Literacy Practice Utilization	GOODALL Science	ELIZABETH SS	CARMEN ELA	GOSSET Mathematics
Literacy Practices Used by at Least Three Participants	<ul style="list-style-type: none"> • use dictionary • research unknown material in text to understand the text • annotate • highlight 	<ul style="list-style-type: none"> • look up definitions • fill in knowledge gaps with facts • annotate by writing on side; use doodling • highlight • use already-known information 	<ul style="list-style-type: none"> • use dictionary or Wikipedia • fill in knowledge gaps with facts • use prior knowledge and discipline-specific training 	<ul style="list-style-type: none"> • annotate • highlight • connect to previous knowledge

Literacy Practice Utilization	GOODALL Science	ELIZABETH SS	CARMEN ELA	GOSSET Mathematics
Literacy Practices Used by at Least Two Participants	<ul style="list-style-type: none"> understand the purpose as to why the text is being read persevere/continue the quest to understand what is being read regulate reading speed depending on the text difficulty recognize having a bad memory and, if necessary, refer to text information later, or reread text two or three times if necessary [self-monitoring] 	<ul style="list-style-type: none"> recognize the purpose for the reading use stickies to highlight areas that need to be reviewed or researched form images in mind of what is being read; those images fill in the gaps in understanding of information 	<ul style="list-style-type: none"> persevere change reading rate use little flags or Post-it notes 	<ul style="list-style-type: none"> recognize when she does not understand [self-monitoring] visualize
Unique Literacy Practices Used	<ul style="list-style-type: none"> break words apart [morphemic analysis] question herself 	<ul style="list-style-type: none"> manipulate text so it can be assimilated create webs and timelines 	<ul style="list-style-type: none"> implement phonics look for keywords 	<ul style="list-style-type: none"> connect words to actual math take a break and walk away for a while

Literacy Practice Utilization	GOODALL Science	ELIZABETH SS	CARMEN ELA	GOSSET Mathematics
Unique Literacy Practices Used	<ul style="list-style-type: none"> • categorize • scan for information wanted 	<ul style="list-style-type: none"> • delve deeper and deeper into text to enable understanding and get more than the general gist • reread 	<ul style="list-style-type: none"> • problem-solve 	<ul style="list-style-type: none"> • complete the math, then try to find an explanation from the words in the text—move back and forth from the math to the text to check understanding • perform a “brain dump” • private speech • paraphrase • model her thinking to that of her students • reread difficult parts • write on her own pieces of paper to figure out the mathematics • sequence

Participants also provided the following further information in discussing some of the strategies they implemented while reading. This revealed more of their thinking. With reference to annotating, Goodall explained that when she reads, she will “stop and find a pencil and write in books,” and, for example, circle information not understood. Another strategy that she

expanded upon was questioning herself while reading. Goodall gave these examples: “How does what I am reading link to what I am teaching?” and, “Am I going to use this for self or class?”

Regarding the question of what reading strategies she used when she read discipline-specific texts, Elizabeth prefaced her responses with, “Sometimes that’s hard because it’s something I do naturally.” At one point, Elizabeth discussed that she utilized background knowledge even though that was not the term she employed. She explained that when reading about the consequences of the French Revolution, her high school and university study of the Revolution gave her “antecedent information” that helped in her understanding. Elizabeth stated that France’s nationalism was one of the results of the French Revolution and reading other information about aspects of the French Revolution allowed her to “unpack it in a different way,” which she found fascinating. Elizabeth realized that once she knew something, it could not be unknown. To help with her teaching, she was able to add gap-filling information to her background knowledge.

Carmen gave a further explanation for a few of her stated strategies. Regarding the implementation of phonics, Carmen explained that she uses phonics to teach reading and writing. She continued, saying that teachers in her school had been required to take a phonics course called *The Writing Road to Reading* (Spalding & North, 2012). Carmen uses the phonics skills learned from this course to assist in her pronunciation of difficult words. She explained that being a fast reader can be detrimental to her comprehension, so she needs to remember to slow down when the text gets hard. When using perseverance and problem-solving, Carmen explained, “the difference between being an adult and being a student is being very self-aware and having the awareness I am struggling, so how am I going to solve the problem. Most students will go, ‘Well, I don’t know.’”

Carmen understood the importance of having, and using, prior knowledge and training that she believed other discipline specialists may not have had. She stated, “Discipline specialists have the prior knowledge and contextual knowledge to apply to their reading.” She gave an excellent example of reading *Northanger Abby* (Austen, 2000) and comparing her analysis of it to that of a non-English specialist. She commented that the science teacher had been really impressed by the way in which Austen made her heroine so well-read, but Carmen disagreed with this analysis and pointed out that the protagonist was quite a shallow Victorian Age character, because she read only Gothic novels. She also did not speak multiple languages, understand history, play music, or sing, and she did not draw, but only painted. Carmen finished her explanation with, “Actually, she’s a terrible heroine for the time because it was expected that if you’re to bag yourself a good husband, you had to be an accomplished, well-rounded woman.” Carmen thought that to recognize the nuances of Austen’s writing, as shown in this example, a person should be a Jane Austen specialist.

Gosset also described select strategies. When referring to talking out loud, she explained that she would talk out loud to herself about the realizations she gains from the reading of discipline-specific texts. This out-loud talking is what is called private speech (Auleear Owodally, 2021; Lantolf et al., 2015). Some of the tactics she used when annotating included putting in symbols for words, such as using $\frac{1}{2}$ for two equal parts, or adding checkmarks on the text where she understood. In addition, she would visualize the number instead of the words. When Gosset “brain dumps,” she dumps all the information about a topic onto a page. She pointed out, “In statistics, a lot of times that would be useful. I could see, like I said, if I saw the word normally approximated, I would want to throw everything on the page that I associate with normally approximated.” Gosset found brain dumping helpful to her comprehension.

Gosset additionally explained about moving back and forth from the math to the text to check her understanding. She used various texts, including the website, to “flow back and forth. My brain does this because I have to figure out little snippets here and there to try and get the big picture.” Gosset did not become serious in her reading and her desire to understand discipline-specific texts until doing her undergrad (in 2002). She explained, “that is when I started using tools [literacy practices] to help me understand”—figuring on her paper, using symbols on texts, using various texts, etc.

Goodall, Elizabeth, and Gosset concluded their responses to the research question regarding which reading strategies they use while reading discipline-specific texts, as recorded below.

Goodall explained that the metacognition part is the “unconscious things that I never would’ve ... considered but am always making those pathways of how do I file this, why is it important, when can I use this, what do I do with it?” Elizabeth completed her list of reading strategies used by giving an analogy:

Learning new things or concepts—I’m able to fill in the words by trying to explain it to you, but it’s almost like you’re a child, and with every new experience you’re learning, you’re going on from there, and it’s a springboard. Your new learning—I could roll over [onto] my stomach, but prior to rolling over [onto] my stomach, I didn’t know I couldn’t do it. And once you roll in [*sic*] your stomach, you can’t unlearn it, and then you learn how to crawl.

This analogy shows the innateness of the use of literacy practices. Gosset concluded her response to the question by stating, “Honestly, I’m pretty sure I use more strategies than this, but I just

don't know what they are." By these quotes, these three participants demonstrated an interest in their thinking as they read. Carmen was the only one who did not provide any closing thoughts.

At the beginning of this study, all four participants were capable readers of discipline-specific texts but did not recognize all the literacy practices, including the ones they used to read successfully. Each participant had a certain amount of cognizance as to how they engaged with texts as they read. But, as will be revealed, the participants employed many more reading-specific nonvernacular social languages (Gee, 2014) than they realized.

Purposes for Reading

In this section, I describe the participants' purposes in reading the self-chosen texts. No matter what is read, successful readers—regardless of the discipline—need to have a purpose(s) for reading (Goodman, 1996; Tovani, 2000). Before each think aloud, participants were asked to explain the purposes of their text choices. Of course, the overarching goal in choosing these articles was to demonstrate their thinking as they read for the research, but for the participants to feel ownership and enjoy the reading, they had further personal purposes for the reading. By demonstrating the participants' purposes, a clearer picture was created of their metacognition and reading engagement.

The purposes determine the aspects of the text upon which the reader is going to focus. Instructors' awareness of their own reading purposes and their own ability to communicate these will more likely assist students in being more cognizant of the reading-specific nonvernacular social languages (Gee, 2014) needed to be successful discipline-specific readers. Each participant had specific purposes for reading their texts. I provide a few examples of their reading goal explanations.

Goodall, the science teacher, chose websites and articles for her think alouds. In choosing these, she would first determine whether the material provided intriguing content. Her next decision was to ascertain whether the reading could wait for the summer or if it had a more time-sensitive purpose, such as if the reading would inform her teacher content knowledge (TCK) (Shulman, 1986) and positively impact her teaching of curricular concepts. Her aim in reading her self-chosen texts included to engage her love of science and to inform her personal interest, her TCK, and her pedagogy.

For Goodall's first think aloud—"Teaching science literacy" (Grant & Lapp, 2011)—her reason for reading was to get information from a "really well-thought-out and really well researched" source to which her Local of the teacher's union subscribes. She was hoping to get practical information regarding teaching science literacy to inform her pedagogy. When Goodall chose *Into the Twilight Zone* (Weiss, 2017) for her second think aloud session, her reading goal was to read purely for the enjoyment of learning about science. Goodall recognized this text as a narrative that helped in the enjoyment of learning about science. She stated that she enjoys Weiss's writing style because "it's a part interview with someone, and it also imparts that short story feeling."

The purpose of "Shape-transformable liquid metal nanoparticles in aqueous solution" (Lin et al., 2017), Goodall's fourth think aloud and the most challenging text, was that she wanted to read something other than a biology text that was an actual scientific article. The text she settled on, from the Society of Chemistry, explored chemical science and nanoparticles. Goodall wanted to complete a think aloud by engaging with a subject with which she was not as familiar, hoping it would force her to employ more reading strategies. As it turned out, this was her most challenging text, and her need was fulfilled, as I explain in a later section.

Elizabeth—the social studies teacher—chose websites and textbook chapters for her think alouds. The functions of the texts were always the same, to develop her TCK so she could instruct her students better. For her first think aloud, Elizabeth chose “The Great War,” a chapter from a *History of modern Europe from the Renaissance to the present* (Merriman, 2010), which is a principal resource for AP SS. Her reasoning for choosing the text was because it is a European history AP program textbook written by a Yale professor. She stated, “I may as well read something that I needed to read, and I’m currently starting, on Monday, World War I and so ... what lead up to the Great War, so the factors, the external factors, the long-term factors.”

Elizabeth recognized when the text was beyond the scope of her SS 20 AP students by stating, “This seems quite heavy for what I want to teach the students. I will have to really streamline, for it seems to focus a lot on all the different underlying tension, [which] is more than what we need to do.” Reading this text did meet her need to enrich her TCK.

“The West Between the Wars” (Ralph & Lerner, 1991) was Elizabeth’s third and most difficult think-aloud text, Chapter 35 of *World civilizations* (Ralph and Lerner, 1991). She chose this text because she was currently studying this topic with her Grade 11 French SS 20 students and wanted to make her reading for this research as pertinent as possible. Elizabeth had done considerable previous studies on this topic, not only because she is a history teacher, but also because she studied the topic while earning her first degree. She explained that the text functioned “to fill in some of the information gaps and to see other perspectives and how another author connected it.” Elizabeth wanted to confirm her TCK and be reminded of possibly forgotten information. In addition, she was hoping to find another back story to use when instructing her students.

Carmen, the ELA teacher, chose an article, a website, PowerPoints, and three excerpts from novels as her think-aloud texts. Carmen's purposes for reading included for entertainment and to inform her personal understanding and her TCK. For think aloud one, she chose an excerpt from *The witches of New York* (McKay, 2016). She had read McKay's previous book and had heard good things about this one. Carmen stated that she found McKay's books interesting, and pointed out, "The first one that she wrote, *The birth house* (McKay, 2007), was very female-centric. Actually, all her books are very female-centric. Not necessarily why I pick them, but it is a reason why I like them." Carmen enjoys fantasy and supernatural genres. This book is about witches; she had done a fair amount of reading about the witch trials, and she wanted to see how she would incorporate her background knowledge with *The witches of New York*.

For her second think aloud, Carmen chose two texts: the website *What are verbals?* (Shrives, 2017) and an online PowerPoint titled *Painting with parts of speech: Participles* (Lacey-Utley, 2009). The functions of both articles, as demonstrated below, was to inform Carmen's teaching content knowledge and then help her explain gerunds—especially participles—to her students. Carmen chose *What are verbals?* (Shrives, 2017) because she was going to be teaching verbals in her ELA 7 class in about two or three weeks. She found that it is difficult (for both her and her students) to determine whether an ING-ending word is a participle or a gerund. Carmen further explained that participial phrases were challenging. She wanted to understand participle verbals and phrases more clearly before teaching them to her students. Carmen chose the PowerPoint *Painting with parts of speech: Participles* (Lacey-Utley, 2009) for the same reasons; additionally, after she had briefly read the first three or four sentences, she saw

that the language/vocabulary seemed as though it would be accessible for her students. Carmen had perused other websites and found the vocabulary more difficult.

Carmen's fourth think aloud text, and the most challenging, was the chapter titled "By the Caspian Sea, the Old Potato Witches," from *The Enchantress of Florence* (Rushdie, 2008). She chose the Salman Rushdie title because she had never read any of his work, explaining that "many people who talk about highbrow literature mention Rushdie. He is on that list. along with people like Martin Namus or Kingsley Amos. I've never read that kinda stuff." She continued, "It takes place in Florence during the Renaissance, so since we studied that in Grade 8 SS, I thought that'd be cool." The purpose was twofold: to quench her desire to read a Rushdie novel and to glean information about the Renaissance setting.

As mentioned in the last chapter, Gosset, the math teacher, read texts that were directly related to the Masters' course she was taking on the history of mathematics. It was a perfect storm because her reading of math texts fit perfectly into this research. Gosset was able to grow in her reading literacy practices and have assistance in understanding the texts. Her self-chosen readings were websites or excerpts from her Master's texts. As demonstrated below, her purposes were the same for all the texts: to glean information to meet her course requirements.

Gosset chose "The algebraic aspect of La Géométrie," a section from her Masters' text *History of Mathematics* (Burton, 2013). She chose this article because it was directly related to her homework assignment. She was working on a module about Descartes, a French mathematician. Gosset gave some background about the historical importance of Descartes's work in math. According to Gosset, he was the first to introduce analytic geometry. He analyzed what had been done a couple of hundred years prior in math, including geometry and revolutionized the way proofs were done. Gosset explained that proofs are not done the same

now as they were 300 years ago, “but they are mathematically the same proofs. There is no mathematical difference between them other than how you interpret [them] and how you read [them] and what symbols you use.” Gosset wanted to get information to complete the module for her Master’s course.

Gosset’s second think aloud, and the most difficult, was *The Guinness brewer who revolutionized statistics* (Kopf, 2015). She chose this article “because I am writing a paper on William Gosset. In William Gosset’s work, he was famously known as ‘student.’ I wanted research on his bio as well as his math.” In this case, she wanted to acquire information to complete a paper.

The above explanations demonstrate the participants’ awareness of their purposes for reading the self-chosen texts. This awareness has the potential to impact their teaching practice. From the perspective of this research, connections can also be made to Rosenblatt’s transactional theory.

Specific Transactional Theory Applications

The participants’ abilities to read the texts demonstrate connections to Rosenblatt’s transactional theory. According to Rosenblatt (2013), readers interact with the text they are reading using a transactional process. Reading is both socially and individually generated. Rosenblatt (1993) points out that while she understood the social generation of language, she recognized that “it is always individually internalized in transactions with the environment at particular times under particular circumstances” (p. 381). According to Rosenblatt (1993), each individual that experiences text—reader, speaker, listener, or writer—“brings to the transaction a personal linguistic-experiential reservoir, the residue of past transactions in life and language” (p. 381). Readers experience the transaction in different ways and at different depths. The text

can be dissected for deep understanding or skimmed over. Even though a reader can be a discipline specialist, each specialist can glean different information from a reader of the same discipline because of their linguistic-experiential reservoir and their reason for reading.

This section will focus on two aspects of Rosenblatt's transactional theory. The first exemplifies the transaction that goes on between the reader, the author, and the text. The second demonstrates how my participants, as readers, took stances (Rosenblatt, 2013)—efferent and aesthetic—as they engaged with texts. They moved along the efferent and aesthetic stance continuum, often blurring the categories. I highlight how my four participants employed these two aspects of transactional theory to show the importance of transactional theory to secondary discipline-specialist reading. As the participants interacted with the authors and moved along the aesthetic and efferent stance continuum, they achieved better text comprehension. Many examples of transactional theory were illustrated throughout the participants' think alouds; a select few will be given to demonstrate.

Transactions With the Authors

According to Rosenblatt (2013), the transaction while reading occurs between the reader, the author, and the text. Rosenblatt (1985) explains that transaction “designates an ongoing process in which the elements or parts are seen as aspects or phases of a total situation” (p. 98). As a text is being read, a fluid transaction flows between the author, text, and reader and between the reader and the author. The reader is actively involved in constructing texts rather than passively consuming them; readers, as much as the text, play an active role in a reading experience. I recognize that this transaction is complicated, not always observable, and is a combination of many practices. The participants demonstrated the transaction between

themselves and the text as they would question or respond to the author's writing. This transaction occurred as they engaged with the text.

Reading is the transaction between authors and readers; the meaning in the text for the reader is not absolute (Rosenblatt, 2013). At times, some of the participants referred to or addressed the authors directly. What takes place between the participants and the authors coincides with Rosenblatt's transactional theory (2013). Participants used their transactions with the authors to engage with the texts. Shanahan and Shanahan (2012) explain that discipline specialists think differently about authors during reading. Reader's views of authors impact how they read the texts differently and to different degrees depending partly on the discipline. For example, the math teacher pays less attention to the author of a math problem than the ELA does to a poet. The purpose for reading the texts could also impact the transaction. Whether the goal of reading was to entertain or to improve TCK, the interaction with the text could be different.

In some instances, Goodall addressed the authors of the texts; this shows transactions with the reader, texts, and authors. For example, during the first think aloud, while reading an article by Grant and Lapp (2011), Goodall commented that she would have liked to have talked with the authors. Due to the authors' variety of science teaching assignments (high school, college, and university), Goodall wondered why they didn't make the article more practical and accessible. If she could have had a conversation with the authors, Goodall would have told them, "If you'd had a lesson plan of how this would actually work out with the identification or engaging them in reading research or teaching them how to read like scientists" it would have made the reading more meaningful. Her desire to talk with the authors demonstrated her awareness of the authors' importance to readers in their comprehension of the texts. Goodall appeared to understand the role authors have in participating in communicating the meaning of

texts. She recognized that the authors provided scant pedagogical details for which she was wanting. Goodall's desire for science-specific pedagogical insights confirmed her as a disciplinary expert in teaching and its Discourses.

While reading think aloud five—"Therapeutic treatment of Marburg and Ravn virus infection in nonhuman primates with a human monoclonal antibody" (Mire et al., 2017)—Goodall commented that the authors had written a scientific article. She explained, "I love the fact that with a scientific article you basically have an idea of what they're going to tell you and how successful they were." Goodall's think alouds revealed her expectations. In her transactions with the texts, her goals were met. Mire et al.'s text fit her schema of the scientific article genre. The author had provided the transactional experience for Goodall.

As Elizabeth was reading her discipline-specific texts, she made several comments regarding their authors, and tried to understand and take into consideration the authors' thoughts about and reasons for writing the texts. She understood the authors were individuals who were trying to communicate with the reader. Elizabeth recognized that the authors had specific perspectives and ideas they wanted the reader to understand. During think aloud one (Merriman, 2010), having read other chapters in the book, Elizabeth commented: "This is the first time I've read where he's [Merriman has] done this." She also deduced that the author was American because of specific information about which he wrote. Referring to the text she was reading, she stated, "I know AP European history is [a] US developed course, so they are really Russia-blaming here." When referring to the author's use of symbols, she said, "It's interesting to know that he uses a lot of the symbols that other authors have used and that we use ourselves in Social 20."

When referring to Cahill's (2006) *Rome, crossroads of the world*—think aloud two—Elizabeth commented (referring to the lack of chronology), “This guy is talking all over the place.” Later, referring to Cahill, she stated, “The author is talking [more] about the Ottoman Empire than what was Turkey.” She concluded that she did not like the way Cahill writes because he made too many connections to modern-day US; he did not “stick with that ideology because he is really focusing on the materialist concept of Marxism,” and he did not follow a specific ideology but seemed to be appealing to such a vast range of readers. Even though she appreciated Cahill's “vivid descriptions of where things are, geographically,” she did not consider the book very scholarly and criticized Cahill's name dropping and “not making an enlightened analysis/analyses.”

Finally, when reading her last think aloud—“Ready or not: Recognizing and preparing college-ready students” (Springer et al., 2014), which was the article I chose—Elizabeth thanked the authors for the organization of their writing, stating, “There it is. ‘... four core reading skills ...’ (p. 300). And it prepares me—thank you. That's what I'm looking for as I'm reading.” Elizabeth saw the importance of trying to relate to and understand the authors. She taught this skill to her students, and, upon finishing the article, explained:

We're doing that more and more with our students in terms of what is the author saying, what is his message, what is the objective—interesting—what's his point of view ... And what is the message? And who is he writing for?

Her modelling of interacting with and asking questions of the authors during reading shows she prized and recognized the genre-specific aspects (Halliday, 1985; Goodman, 1996) of her texts.

Carmen was cognizant of how the authors communicated the ideas within the book and commented on it. For the first think aloud (McKay, 2016), she explained, “Something that

bothers me with books like this is the shift in perspective.” In response to think aloud three—*The Finnish example: What can we learn from Finnish curriculum reform?* (Kardynal-Bahri & Smith, 2017)—Carmen showed disdain for the authors and their perspectives. She was cognizant of the authors’ backgrounds and was aware of the school in which they taught. She stated, “The authors are disappointing.” She did not like the article because “I think that these teachers are really, really hard on the Alberta curriculum. ... I feel like these authors are not giving teachers credit.” Whilst reading her fourth think aloud—*The enchantress of Florence* (Rushdie, 2008)—Carmen was curious about Rushdie’s writing style and attitude, stating, “This is the only thing by Salman Rushdie that I’ve ever read, and I wonder. I’m almost interested in reading some of the other stuff to see his thoughts on women because I’m not really sure how much he likes them.”

Gosset was also aware of the authors of her texts. Asking about Burton (2013), the author of her first think aloud—“The algebraic aspect of La Géométrie”—when not understanding a portion, she queried, “Why would he do that?” While reading her second think aloud (Kopf, 2015), she commented on how she loved the following sentence: “He possessed a wickedly fertile imagination and more energy and focus than a St. Bernard in a snowstorm.” A few times, the author even posed problems that Gosset appreciated, as she laughed with enjoyment when the problems were presented. Kopf uses the word “scary” to describe math, and Gosset did not like this choice of words. She explained. “Math is not scary. It kind of actually makes me feel a little bit icky when people talk about math in a negative connotation.” Gosset reflected on the author’s word use:

So that must be what he’s talking about; the wider error distribution is that he is probably going to have, or maybe he hasn’t termed it margin of error just yet, or maybe it’s the

author's use of the words here so far, but that the margin of error must be larger, so instead of going from 1 to 2, it must be going from 0.5 to 2.5 because that's the wider gap.

During the reading of the third think aloud—"Student's *t* distribution" (Ahsanullah et al., 2014)—Gosset commented that the authors had "nice factual stuff."

Goodall, Elizabeth, Carmen, and Gosset were aware of an author's presence in their reading. The participants' awareness reflects their attentiveness and effort to be active agents in the transaction between reader, text, and author.

The Blurring of Aesthetic and Efferent Stances

This section will demonstrate the participants' blurring of Rosenblatt's (2013) aesthetic and efferent stances. The blurring of the aesthetic and efferent stances (Rosenblatt, 2013) that the participants demonstrated as they read their texts was also significant, because experiencing both emotional (aesthetic) and intellectual (efferent) responses to the reading assisted with text understanding. All the participants demonstrated a consistent efferent stance throughout the reading of all the texts, because the purpose of the reading was to reveal how they read discipline-specific texts, which implies looking for knowledge. Participants were passionate about their subject areas, as demonstrated by the overlapping of the two stances. Regardless of the text, each participant's love of learning about their discipline led to the simultaneous occurrence of efferent and aesthetic stances. Paulson and Armstrong (2009) maintained that "differences in orientation within a stance, depending on whether the reader's initial decision was to treat the text as either literary [aesthetic] or informative [efferent]... , could be thought of as a 'stance within a stance.'" (p. 88). At times, participants' reading seemed to position the stances with equal value, not one inside the other, but occurring simultaneously.

Rosenblatt (1993) explains that the aesthetic is not an intrinsic characteristic in every

text. Despite this claim, the participants appeared to bring an aesthetic stance to texts because of their passion for their disciplines. Besides the words used to describe the participants' metalinguistic awareness, the aesthetic stance was recognized by enthusiastic and excited voices as they read. Through these expressions, they demonstrated their passion for their disciplines and the texts they chose. Using words and phrases such as "love," "like," "good," "fun," "shame," "hate," "enjoying," and "that's interesting" indicates a move toward the aesthetic. The flow through the efferent–aesthetic continuum was demonstrated numerous times throughout the reading of the different texts, as exhibited in the following examples.

While reading her first think aloud—*Teaching science literacy* (Grant & Lapp, 2011)—Goodall commented that, as a teacher, she loved the first paragraph:

It talks about the fact that, especially when you're in Grade 12, you have some decisions to make. I do like the fact that she is conflicted, and it really sort of gives her the idea of whether or not she should be a good citizen and what she has learned from science.

During the second think aloud—*Into the twilight* (Weiss, 2017)—she commented, "That's kind of a shame. So, this technology has gone to at least catalogue what was going on, but they don't have enough information or technology or time to talk out how all their interactions work." Her comment, "That's kind of a shame," indicates a move toward the aesthetic side of the continuum.

Later, during the same think aloud, Goodall commented, "I'm really enjoying the way he writes." She explains this is because the text is "written in a storytelling type of way." Within the context of Goodall's readings, her use of words and phrases such as "love," "like," "That's kind of a shame," and "enjoying," reflect an emotional or aesthetic stance among the reading for knowledge (efferent stance).

At times, Goodall found humour in the reading, which also is an example of moving toward the aesthetic side of the continuum. For example, while reading the third think aloud—*Buzzkill: Will America's bees survive?* (Volk, 2017)—she stated she loved the use of languages and laughed as she gave the following example: “Prophylactically, like condoms—instead of using it like a condom, just use it like when you have a pest infection or an infestation. That’s hilarious.”

Elizabeth demonstrated several instances where she moved toward the aesthetic side of the continuum. With reference to think aloud one—*The great war* (Merriman, 2010)—she commented, “Interesting; very fascinating because if you got Russia, that’s aligned against Britain, France, and Turkey, and then how it shifts during the first world war where Russia goes on the side of Britain and France opposing Turkey. Interesting.” During the reading of think aloud three—*The west between the wars* (Ralph & Lerner, 1991)—she makes the following comment regarding “Democracy of the West today is the forerunner of Marxism...”:

Which is fascinating, and I wouldn’t have thought that was Adolf Hitler highlighting that perspective, considering that one of his crisis actions of the burning of the Parliament and blaming it on the Communists is one way that he took power. It’s fascinating that democracy is based on Marxism. (Ralph & Lerner, p. 535)

Later in the same reading, Elizabeth commented that she liked a particular sentence “because sometimes I struggle with teaching the idea of totalitarianism versus the idea of a dictatorship, and I want to make them see the difference between the two—one being the political system and the other being a regime.” Elizabeth’s desire to learn more, both for her students and for her love of history, is an example of where Rosenblatt’s (2013) efferent and aesthetic stances overlap.

Carmen showed an aesthetic stance when reading her texts. During her first think aloud—*The witches of New York* (McKay, 2016)—she voiced that she liked the vocabulary in the book, which fits her self-identification as a vocabularian. A word she picked from the first think aloud was “wayward,” which she called a fun word. Carmen also said that she liked how the book was “interspersed with articles and little selections.” When referring to the first text in her second think aloud—*What are verbals?* (Shrives, 2017)—she stated, “I’m not totally hating this thing.” In addition, she used phrases such as, “This is good!”; “That’s a nice one.”; “This is cool; this has some stuff for kids to actually do”; and “This one is lovely.” While referring to the PowerPoint (Lacey-Utley, 2009) the second reading from the second think aloud, she commented that the more she read, the more she appreciated what she called a “student-friendly” website because it gradually gave explanations.

While reading think aloud four—*The enchantress of Florence* (Rushdie, 2008)—Carmen commented that she was interested in the meaning of “the old potato witches.” Later in the chapter she finds humour and states, “I love how he brings the guy’s head with him in a jar. Funny. That’s awesome.” Regarding the researcher-chosen text and her last think aloud—“Ready or not: Recognizing and preparing college-ready students” (Springer et al., 2014)—Carmen commented, “I like these little anecdotes. They are interesting, actually.”

Gosset, the math teacher, showed great enthusiasm and passion for the subject area. I was pleasantly surprised by the zeal Gosset exhibited while reading her discipline-specific texts, because I misperceived the lack of excitement a math teacher would bring to their text. Some of her enthusiasm could have been related to her need to find material for her Master’s course, so she had more invested in my research process. She even stated, when doing the math associated with the reading, “This is the part I like that everybody else hates.” Throughout the readings of

all her texts, she consistently used words and phrases such as “good,” “interesting,” “fine,” “beautiful,” “like,” “don’t like,” and “that’s kind of sad” when referring to both alphabetic and numerical texts. She used the verb “like” over 35 times.

Following are specific examples of Gosset’s aesthetic stance while reading. About her second think aloud—*The Guinness brewer who revolutionized statistics* (Kopf, 2015)—she stated, “I love when I say the word ‘calculating.’” She also commented, “I like that term ‘intelligent decisions,’ about their materials they’re going to use for their beer.” Gosset also stated, “I like when you simulate things because it goes back to scientific methods.” When referring to Gosset (whom the participant was in the process of researching and who was the subject of Kopf’s (2015) article), the participant-Gosset commented on her admiration of the statistician-Gosset:

It’s kind of cool that the guy I chose to do is the founder. It makes me feel a little bit more passionate about it. I knew that he had a lot to do with it, but until I dived into this, I didn’t know half of this stuff—a quarter of it!—it’s very interesting.

Gosset even found a couple of quotes from this article that she was going to put up on the classroom wall for her students. One quote (referring to Student’s t-distribution) was, “It is among the pillars of modern statistics, and among the first things learned in introductory statistics courses. It is the source of the concept of ‘statistical significance’” (p. 6). Gosset showed empathy—an aesthetic quality—for the statistician, Gosset:

It kind of sucks a little bit for Gosset that he could have gone further and further with it; ... Gosset was the ideas man. ... He didn’t really want to deal with the heavy-duty proofs of it being applied to everything. He want[s] to apply it to his work... so when I think about [him being] mostly ignored, I figure no wonder. That’s kind of sad.

Gosset is interested in the content (efferent) to write the paper for her course, but she is emotionally (aesthetic) invested in the reading as well.

As Gosset was reading her fourth think aloud—*Random sampling error* (Shuttleworth, 2009)—some aesthetic stance examples include: “I love this. They know what [it] is, so let’s just go on and manipulate it. That’s my poem ‘Lying with Statistics.’” She also liked the term “representative sample,” which was significant to her. Gosset commented, “I really like that, so much to the point that I’m going to highlight it. ... That’s a nice term.” In addition, she liked: “The margins of error would be perfectly acceptable, in these cases, but the overall findings would still be horribly wrong” (Shuttleworth, 2009, p. 2).

Gosset’s response to her fifth think aloud—*The legacy of Gauss: Congruence theory* (Burton, 2013)—revealed her engagement with aesthetic stances as well:

To label what he did as she read specifically, like this symbol with three [lines], because it is interesting to know that equal signs and congruency signs are not the same. But is nice to see it’s close, and [uses] the analogy of an actual equal sign, because they are really meaning the same thing, but you are not allowed to use a straight substitution.

She found parts of the text to be “a nice meaty, tidy little thing’ and appreciated, “Okay, in the same vein, we could talk about the number four. I like the number four, but it’s really the number six that is important for me.” Gosset thought it was “cool when you can make up your own numbers versus their numbers.” At the end of the reading, she commented, “It is very interesting, but it is very easy to get bogged down in it.”

With the knowledge of Goodall, Elizabeth, Carmen, and Gosset’s blurring of aesthetic and efferent stances, the next section contains an exploration of the literacy practices they used to engage with their most difficult texts.

Teacher Engagement of Difficult Discipline-Specific Texts

The think alouds with which the participants engaged provided an abundance of data. When trying to determine the literacy practices or nonvernacular social languages (Gee, 2014) used by the participants, I chose the text that the teachers found the most complex, expecting that this would uncover the most significant number of reading skills and strategies. The literacy practices employed to read these problematic texts might be like the ones used by students reading difficult texts at their levels (Pergams et al., 2018; Springer et al., 2014; Lin et al., 2002). I am aware that the difficulty of texts is subjective and related to the individual reader; however, when reading a challenging text, whether the reader is 15 years old or 40 years old, they must possess certain reading skills and strategies in order to comprehend the text (Lesmeister, 2010; Bohn-Gettler et al., 2011). The biggest difference would be the greater reading experience and background knowledge that proficient adult readers possess. Readers, according to many literacy scholars such as Frey and Fisher (2013), Beers (2003), and Pressley and Afflerbach (1995), need to strategically choose and purposefully use various literacy practices to comprehend. Di Domenico et al. (2018) emphasize that readers of discipline-specific texts require both content-literacy strategies and disciplinary-literacy strategies. Lent (2016) goes further and explains that reading strategies need to fit the discipline-specific texts.

To demonstrate how the participants engaged with discipline-specific texts, the metalinguistic awareness that took place during their reading needs to be explained. Reading is a complicated, highly intellectual endeavour in which the skills and strategies used to understand the texts often overlap or are tied together. The following demonstration of the participants' text engagement is not meant to simplify or underplay reading's complexity. Correspondingly, Alvermann and Moje (2013) assert that, "reading is among the most complex of human

processes, situated in myriad human practices. No simple, linear model will explain it ...”

(p. 1099). The participants often had to employ several literacy practices, including reading skills, strategies, and thinking processes at once, to understand the text. Additionally, there were reading practices that were evident of which the participants were not aware, and therefore, they did not communicate about them or did not know the label for them. Often, they communicated metalinguistic awareness without possessing the language I thought necessary to communicate what they were doing concisely.

Participants' Use of Literacy Practices

The connections the participants made with their texts, which were text-to-text, text-to-self, text to world, or text-within-text (Ellery & Rosenboom, 2011), demonstrated depth of background knowledge and the ability to analyze and synthesize. Some of the reading-specific nonvernacular social languages (Gee, 2014) that the participants displayed—reading skills, strategies, and thinking processes—included inferring, predicting, summarizing, synthesizing, analyzing, visualizing, questioning, skimming, scanning, self-monitoring and/or using text clues to understand an unknown word (Beers, 2003). The most difficult texts they chose tended to cause them to use more reading strategies and thinking processes than their other text choices.

I will provide examples of the literacy practices used by participants while they read their most difficult texts. Page numbers given within quotes are stated by the participants to communicate the location to which they were referring, unless the page numbers are within []. All the participants demonstrated many examples of literacy practices, but I have provided only a few examples in this paper. Throughout this section, most of the literacy practices or nonvernacular social languages (Gee, 2014) employed by the participants have been bolded. The majority of the strategies and thinking processes presented are reading skills, as these had

become automatic to the readers. In many instances, the participants' verbal explanation of their thinking described the engagement, but they did not think to label the literacy practices employed. In the following analysis of the participants' reading of their most difficult texts, the literacy practices highlighted tend to fall into content-based literacy. These practices are important to being able to read as a discipline specialist (Di Domenico et al., 2018).

The Science Teacher. Goodall's most onerous text—her fourth think aloud—was “Shape-transformable liquid metal nanoparticles in aqueous solution” (Lin et al., 2017). This photocopied text came from an electronic journal Goodall had found using Google. She required New Literacies reading skills (Leu et al., 2013)—the ability to navigate the world wide web—to find this journal. Even though Goodall's science major was biology, she wanted to stretch her reading ability by reading a chemistry text instead. She commented on the text's difficulty: “I'm already finding that it's not as easy to read because it's not like the narratives we read before.” The articles she had previously chosen for the think alouds were written in a more narrative style. Goodall wanted to complete a think aloud with a subject with which she was not as familiar, thus hoping to force herself to employ more reading strategies. In the following excerpt from the abstract of Goodall's hardest article, the complicated chemistry-specific content, vocabulary, symbols, and acronyms can be seen:

Stable suspensions of eutectic gallium indium (EGaIn) liquid metal nanoparticles form by probe-sonicating the metal in an aqueous solution. Positively-charged molecular or macromolecular surfactants in the solution, such as cetrimonium bromide or lysozyme, respectively, stabilize the suspension by interacting with the negative charges of the surface oxide that forms on the metal. (Lin et al., 2017, p. 2832)

It demonstrates the high degree of lexical density that, according to Shanahan and Shanahan (2008), science texts tend to contain. This article itself exemplifies chemistry nonvernacular social languages (Gee, 2014) or Discourses (Gee, 2002); this made it more difficult for Goodall because biology was her focus. To a non-chemistry or non-science reader, this is a challenging text.

Goodall used several reading skills, strategies, and thinking processes, including predicting, rereading, determining the meaning of difficult vocabulary, self-monitoring, and recognizing genre structure and organization. The following are examples of the various engagement tools Goodall used.

Goodall **predicted** by commenting, “So, like in the introduction, they told us why they’re actually investigating gallium rather than mercury because mercury is very toxic. So, this could mean some really promising ways to use gallium rather than mercury ...” When Goodall stated, “this could mean,” it reveals **predicting**. Later in the article, the article discusses how gallium can be used, which verified her prediction. Furthermore, Goodall would make predictions of possible unknown word meanings. When it came to the word “sphere,” she stated, “Well, a sphere would be many things within it, so the sphere of knowledge or sphere of whatever, but nano is very small. That’s what my brain is sort of hypothesizing ...”

Synthesizing and **evaluating** are revealed when Goodall explains, “it reinforces their ideas of being able to use it in all sorts of different ways. So, all the strength of all those things makes it more applicable in everyday life.” She evaluated and then integrated different ideas to see that things were applicable to everyday life.

Goodall **reread** portions of the article a few times and then would skip other parts of the article. She explained, “I sometimes have to go back and reread the words so that they actually

fit together in my head better.” She also reread another portion to better understand and apply the definition of a word to the contextual meaning. Goodall would **skip text** for two reasons. The first was when she came across “the stuff in parentheses, because I’m not really reading for that.” Second, Goodall skipped the “Methods” section of the articles “because that’s not really important to me, because I’m not looking to go home and do this experiment.” Both skipping ahead and rereading are **self-monitoring** skills or strategies.

When Goodall came across **vocabulary** she did not know, she Googled it and most often came across a Wikipedia definition. For instance, she stated she did not know what “galinstan” meant, and then looked it up on her phone, and explained:

If you’re removing gallium, what is “galinstan”? It is something we use all the time? That’s what my brain is doing—how do I decode this? All I see in there is gallium and nothing else. Oh, [she used Wikipedia] galinstan is a commercial liquid metal alloy whose composition is taken from a family of eutectic alloys mainly consisting of gallium, indium, and tin. Such eutectic alloys or liquids at room temperature, typically melting at -19°C .

By looking at other text resources to find assistance, Goodall demonstrated the ability to self-scaffold (Fani & Ghaemi, 2011).

In another instance, Goodall found the word nanosphere and stated, “I don’t know what a nanosphere is. I know what nanoparticles [*sic*] is but not a nanosphere” She was using her **background knowledge** to try to figure out the meaning. Goodall then used her phone to find the definition. Goodall’s ability to speak both French and English fluently helped in the understanding of difficult words. She stated, “Interesting. I’ve never seen this, “facile,” in English. I’ve seen it in French but not English, and it means easy.”

In many places, Goodall would **read quietly out loud to herself (mumble reading and private speech)**, especially when the reading was most difficult. The use of **mumble reading** and **private speech** are part of her **self-monitoring** system. Another example of **self-monitoring** occurs as Goodall is trying to understand a formula. By stating, “I can understand the letters, and I can understand the numbers, but I can’t see what it means,” Goodall is aware of when she does not understand what she is reading. As with most of her usage of her literacy practices, Goodall needed to be self-aware as to when to use the needed skills and strategies. She recognized that this was a difficult text to read, and she needed to read closely. Goodall was aware of her need to be engaged with the text by finding interest quickly; this means, by the time she finishes the introduction. If she had trouble understanding within the first page, she would have had very little willingness to move forward and continue reading. This **self-awareness** assisted her **self-monitoring**.

Understanding and **recognizing text structures and organization** (text genre) also increased Goodall’s engagement with her article. Some examples of Goodall’s recognition of text structures include identifying footnotes, understanding the figures and photos, and recognizing the use of parenthetical comments within the reading. Referring to the references, she stated, “Just wait, there are those little numbers—obviously they would have to be references.” After looking at the number, she went to the reference list. Discussing Figure 1 (Lin et al., 2017, p. 2833), Goodall used the pictures for information and stated, “so already you can see from the pictures that it was able to bond.” When comparing the photos in the article, Goodall explained that she preferred black and white photos because she could see things more clearly in them. Using this text feature reveals her attention to the photo as well as her self-

awareness as a reader. Using the photos in this article was very important to her understanding of this difficult text:

I don't know anything about it [text information], and the photos help me, remind me, or sort of reinforce the shapes and what it does and the fact that it's an actual picture; it's not like a diagram or a representation that I actually have the truth in front of me, so it helps to reinforce the things that are written, especially [if] I do not understand it.

The photos confirmed the information she was reading. By using the pictures, she was additionally making **text-within-text connections**.

When it came to genre or text organization, Goodall found the placement of the figures or photos to be awkward within the texts. She thought they should have been placed right beside the texts to help with her understanding. Another important aspect of **text organization** was Goodall's awareness of the organization of an article published in a scientific journal. She thought it was "very categorized" and anticipated seeing the categories, such as the abstract, introduction, results and discussion, and methods sections. She referred to the categories in the articles as "chunking into manageable pieces." When referring to the beginning of the article, Goodall elucidated, "the introduction summary [helps] you want to read the article, and it'll tell you what's good about it right away, so it's really up to you to move past the introduction and get into whether it's resolved or discussion."

Goodall knew that the article would be more challenging to read than the narrative types of texts she had read in earlier think alouds. Because of its difficulty, Goodall expected she would have to look up unknown words, and it would take longer for her to read. She did have the **reading resiliency** to engage, comprehend, and finish reading the article.

The Social Studies Teacher. The most laborious text that Elizabeth chose was her third think aloud—*The West Between the Wars* (Ralph & Lerner, 1991)—which explains the rise and fall of democracy in Western countries between the two World Wars and some of the causes of World War II. As already mentioned, Elizabeth chose the text because she was currently studying this topic in her French SS 20.

Elizabeth had done quite a bit of previous study on this topic, not only because she is a history teacher, but also because she studied the topic in her first degree. Elizabeth used a variety of reading-specific nonvernacular social languages (Gee, 2014) as she read through her text. She tended to go through a reading cycle where she read, analyzed, synthesized, and then applied the newly formed information gleaned through the combination of her knowledge with the information from the text. Besides this reading cycle, Elizabeth would often use a variety of reading strategies individually or simultaneously, such as visualization, looking back, self-monitoring, questioning, paraphrasing, and summarizing. Her vast TCK was evident and applied consistently, making connections to what she was reading.

By consistently **using her background knowledge**, Elizabeth **made connections** with her text. After reading an introductory quote, Elizabeth made the following comments about it, which revealed her use of **background knowledge** and **making connections**, enabling her to **synthesize, evaluate, analyze, and apply** new information.

Hmmm! ... Which is fascinating, and I wouldn't have thought that, was Adolf Hitler highlighting that perspective considering that one of his crisis actions of burning the Parliament and blaming it on the Communists is one way that he took power. It's fascinating that democracy is based on Marxism. ... Interesting, he was democratically elected, but he says that "democracy created a monstrosity of filth and fire," so it's kind of

like foreshadowing his opposition to democracy ... so it's interesting. Thanks to Adolf Hitler for that quote.

Her use of sarcasm (“It’s fascinating that democracy is based on Marxism. ... Thanks to Adolf Hitler for the quote,”) revealed her lack of regard for Hitler’s comments and her engagement in the text.

Using her **background knowledge**, Elizabeth **visualized** the maps of countries as she read, “Among the claims made by the Allied Powers ...” (Ralph & Lerner, 1991, p. 535). She stated, “In my mind, I have the visual of who the Allied Powers are of the first World War. So, right away, it gives me that image of Great Britain and France and Russia.” When referring to her use of **visualization** when reading the text and applying it to the curriculum, Elizabeth explained that she can make a visual of where exactly the information is in the curriculum, “so I think of totalitarian and exactly where is it in my unit with the 12’s when I’m teaching them. That’s the image that I have in my mind ...” Elizabeth used her **background knowledge** several times to visualize.

Looking back and **rereading** were **self-monitoring** strategies Elizabeth employed. For example, when she read, “Rather than encourage the growth of democracy, those events were often the direct cause of its decline and fall.” (Ralph & Lerner, 1991, p. 535), she needed to look back in the paragraph to confirm the antecedent of the pronoun “those.” After rereading, she stated, “So, obviously by saying those events, he’s referring to that “disillusionment and desperation” in the events that followed in the wake of the war ...” By **rereading**, Elizabeth showed **self-monitoring**. The process she took to understand the text included **questioning** and **paraphrasing** what the authors were saying. She asked, “Okay, I’ll see what he talks about—what are “those” events?” Showing **paraphrasing**, she explained:

Oh, I see what he's saying. It's not since [the] 1940s it's the first World War—okay, okay that to me wasn't that clear for that moment. So, he is talking about after the first World War. There was a decline of democracy ... He's talking about that this chapter is to foreshadow the rise of Hitler and Nazi Germany and Communism. The opposition of those conflicts to [the] liberal democracy of Britain, France, and the United States—okay.

By saying, “I am tired, but I didn't make the link until now” shows that she has regained understanding, and her **self-monitoring** was successful.

Elizabeth demonstrated awareness of learning new information—**self-monitoring**—several other times. One example is that she would state, “I didn't even know that. I did not know.” Elizabeth also used **skipping ahead** to assist with **self-monitoring**:

I'm **skipping ahead** and not reading this information because I am anticipating a section talking about where Lenin is ... If you saw that I checked the page to see [if] they [are] going to talk a little bit about Lenin and then how do they then discuss ...

The **self-monitoring** skills Elizabeth employed demonstrated her awareness of what she needed to comprehend the text as well as glean the information she sought.

Elizabeth was very aware of her **background knowledge** about Lenin and was looking for that information in the text. As well, she was aware that she did not want to read about Communism because she felt her background knowledge was sufficient. Later, as she was reading the text, she came across the information about Lenin for which she had been looking:

What I'm looking for is the death of Lenin in January 1924, so why did the books say the USSR came into existence, and the Constitution was adopted [in the] beginning of the USSR, and that Lenin had a hand in it, when he died in January 1924? So, it's exactly what I wanted to see.

In addition, Elizabeth articulated her **questioning** to show what she was looking for. She was concerned that the consequences of the assassination attempt on Lenin's life were not explained, but she filled in the gap with, "It is the fact that the attempted assassination of Lenin actually resulted in his incapacitation."

Elizabeth **summarized** information, as shown in the following quote: "The author is discussing the difference in the last sentence talking about class struggle and so then when he talks about the economic system and the 'possession of aristocracies'" (Ralph & Lerner, 1991, p. 535). Then from the information in the **summary**, Elizabeth **predicted** what the author was going to talk about next. Elizabeth looks for specific wording in the text to **predict**:

When he [the author] talks about the economic system and the "possession of aristocracies" (Ralph & Lerner, 1991, p. 535), then I know that he is going to be talking about Communism, so that gives me those types of specific wording [that] leads me to make that link regarding Communism.

Elizabeth combined **analyzing, synthesizing, and visualizing** in the following quote referring to information on page 536 (Ralph & Lerner, 1991) which explains the creation of new nations after World War I:

I had to do a visual of Poland, Finland, Austria, and Hungary [which] were separated into Yugoslavia and the Czech Republic, so the creation of these new nations encouraged the debilitating economic rivalries. I suppose by separating those countries, I would have to think about that debilitating economic rivalry and the fact that the area of Poland [that] was taken away from Germany ... then became that corridor that Germany would've wanted back ...

This SS teacher concluded that her **synthesis** of the information reflects the information given by the authors.

Elizabeth would often say, “I wonder ...” In one instance, when **synthesizing** and **evaluating** information, she pondered the author’s information about the czar’s abdication and Lenin’s takeover of Russia. She recognized that the authors present Lenin as a powerful and able leader who possessed a firm ideology. The authors also portray Lenin as a revolutionary, administrator, and strategist, who demanded respect and loyalty. Elizabeth explained that often (in her opinion), Lenin is presented in a much different light than the way in which these authors portray him:

Lenin, not only when he took over, they went into civil war not long after, in 1917, so he was also in that timeframe of that Civil War and that he had even introduced Communism in order to help people after the first World War. They were struggling with food and famine. He actually won based on his speech of peace, bread, and land, and they’re making Lenin sound like a strong revolutionary in this book. **I wonder** if it’s because of how old the book is—that there has since been information ...

Elizabeth engaged her background knowledge to ask herself, “I wonder...”.

In **synthesizing** and **summarizing** information, Elizabeth **inferred** and **drew a conclusion** about the text. She **made connections to herself** when referring further to the portrayal of Lenin in this reading:

In the timeframe from when I was younger and in university, so 30 years ago, they didn’t have as much information on Lenin as they do now, and I only can assume the fact that a lot of the information was hidden at the time, because of the Cold War.

She draws on her **background knowledge** to infer and make connections.

In many instances, Elizabeth **made connections to herself and the world**. For example, when referring to the sentence, “Finally, nationalist sentiment encouraged discontent among minorities in the newly established states of central Europe” (Ralph & Lerner, 1991, p. 536), Elizabeth elucidated:

I’m thinking about a whole bunch of ethnicities in the country. These different ethnicities—feeling loyalty to their own ethnicity—then caused conflict within the country. So, then I think about Yugoslavia as an example, or those in the Czech Republic ... because then I had to make a connection to, “how am I gonna add this?”—which is a really good point—that I would like to present to my students. So, to me, this is a piece that I’m going to highlight ... Just so I don’t forget to teach it ...

The connection to herself was to make sure she taught this information to her students, and she **highlighted** this information and added a **Post-it note** as a reminder. She **made connections to the world** by referring to Yugoslavia and the Czech Republic.

Elizabeth made many connections as she read, which shows her strong historical background. When she was reading about Lenin, she recognized that some information was missing, and made a **text-to-world connection**:

During the Civil War, Lenin was hit with a gun to the head [shot], and so from 1920 to 1924, he wasn’t actually around. When he died in 1924, Stalin took over right away. There was a fight for power [and] Stalin took over in 1928/29, but Lenin, because of the Civil War and being hit in the head by a bullet, he was kind of erased, and he was not much involved. So, he didn’t have all the power that Stalin had.

She made **text-to-self** and **text-to-world connections** many times. For example, when Elizabeth read certain things about Trotsky, such as, “Before the revolution he had refused to

identify himself with any particular faction, preferring to remain an independent Marxist” (Ralph & Lerner, 1991, p. 537), it reminded her that there were two types of Marxists—Bolsheviks and the Mensheviks—and that Trotsky preferred the Mensheviks.

She was also reminded (**text-to-self**) that she wanted to explain more information to her students:

First, you have to unite the proletariat, and second, you have to do that dictatorship of the party, so then it brings me exactly to this understanding [of] “bloody combat between the Reds ... and the Whites” (Ralph & Lerner, 1991, p. 538) when I explain the Whites to my students as monarchists.”

Furthermore, there were instances where she made **text-within-text connections**. Elizabeth made connections to Lenin’s information from different parts of the text.

Elizabeth was aware of the chronological **text organization** and enjoyed “how this author presented the beginning of the chapter and then is moving through the chapter where it is first this, second this, third this. ... He develops it in such a way that it is easy to follow.” She did, however, find some of the text organization puzzling. She found it difficult that the authors skipped the timeframe, and explained, “It went from presenting the west between the wars and talked about ideologies and then started talking right away about the rise of totalitarianism.” By commenting on both instances of **text organization**, she also shows **self-monitoring** because she is aware of what types of text organization are more comfortable for her to follow.

The English Language Arts Teacher. Carmen’s most challenging text, her fourth think aloud, was a chapter titled “By the Caspian Sea, the old potato witches,” from *The Enchantress of Florence* (Rushdie, 2008). Carmen addressed the difficulty of this text in comparison to the other texts she chose for the think alouds, saying, “I had to spend a lot of time thinking about the

words and doing sentence or words in the context of sentences.” In addition, she found “the structure of it is so strange that it’s hard to [read] because it’s not very linear, so it’s hard to focus on sometimes.” Carmen had been reading it on and off for maybe seven or eight months. She would end up picking it up when she had nothing else to read. Carmen stated, “I’ve kind of been struggling along with it. It’s really weird, and I think you’ll see why as I go. I’ve been reading it since August.”

While reading this demanding text, Carmen used many reading-specific nonvernacular social languages (Gee, 2014), such as summarizing, making connections, mumble reading, private speech, self-monitoring, text feature and structure awareness, and questioning. Before reading the selected text for the think aloud, Carmen gave antecedent information and **summarized** what the story was about thus far and gave some explanation as to why it had been a more challenging read for her:

There is this person who has come from Italy in a gold coat, and he makes a big thing out of this gold coat, which I can’t remember why. It’s been a while since I’ve read this, but he ends up in the Mugov [spelling?] capital, which is a part of India, and he’s telling the story ... I think, structurally, it’s sort of like Scheherazade or the Arabian nights or something like that because it’s very meta-. It’s a person telling a story, and then you kinda get sucked into the story. And I find that it’s a little hard to know when this is actually happening and when is it the story he’s telling?

Carmen verbalized many **connections** as she read. She consistently made many (over 40) **text-to-self, text-to-world, text-to-text, and text-within-text connections**. I’ve provided only a few of the many examples. Since she was teaching the Grade 8 SS Renaissance Unit, she would be able to relate to the text and maybe learn more about the era—**text-to-self** and **text-to-world**.

The following quote has examples of **text-to-self**, **text-to-world**, and **text-within-text connections**:

His name is Akbar the Great, but ... earlier they talk about these three friends [**text-within-text**], one of whom is Machiavelli [**text-to-world**], which is partly what sucked me into this because I'm very fascinated by Machiavelli. And I'm a bit Machiavellian myself [**text-to-self**].

Here is a quote that includes **text-to-text**, **text-to-self**, and **text-to-world connections**:

I actually know that that city [Marv] exists [**text-to-world**] because there is this British quiz show [**text-to-text**] that I like to watch [**text-to-self**], and they had a series about the letter M. And there was one that they talked about, here are four places that start with the M and which of them is fictional, and some of them actually guessed Marv.

A **text-to-text connection** was made to *The Three Musketeers* (Dumas, 1878), which demonstrated Carmen's ability to recognize and understand **allusion**, which is an important skill when reading ELA texts (Lent, 2016). She stated, "I wonder if it is a different version of Athos, Porthos, and Aramis [*The Three Musketeer's* protagonists]. The D'Artagnan used seems to be a giveaway, but half of me feels that's too easy. I don't know." Carmen's many connections demonstrate her strong **background knowledge** regarding the subject, as well as her ability to apply that knowledge. Carmen asked herself **questions** or used **mumble reading** several times. She explained that sometimes when she hears things, she can think about them differently:

[**verbalizing**] organizes my brain differently, I guess. I'm used to talking to myself. I talk to myself all the time ... Usually, if I'm mumbling, I'm not skipping ahead, but I'm processing that immediately, so I want to read out loud to hear it, so I mumble and then understand it.

To explain her need to hear information, Carmen stated that as a singer, when learning and memorizing a piece of music, she must listen to it repeatedly because she is not a very good sight-reader. By hearing the music lyrics often, she is better able to memorize it.

Carmen used **self-monitoring skills**. She stated, “The structure of it is so strange that it’s hard, because it’s not very linear, so it’s hard to focus on sometimes.” Carmen was aware of the structure and aware that she struggles with it. Along with self-monitoring, Carmen showed **perseverance**:

If I were a worse reader than I am, I think this book would kill me. Either that or I would just quit. But lately, I’ve been better about quitting books that I’m not interested in rather than just struggling through it, but I kinda want to say that this is one, just to say that I did, and throw it on my list of 50 books.

Text structure and **text feature awareness** were demonstrated as Carmen read:

So, one cool thing about the chapters is ... all the names of the chapters [are] part of the very first sentence of the chapter. I’m not sure why he really did it, maybe to make it as a transition or connection, but I think it’s really cool.

Carmen showed her recognition of **text features** by stating, “The regular text is what Akbar the Great is relaying as the story. The italics are the interjections from his listeners.”

Like many good readers, Carmen made several **inferences** to help with the text, for example:

I think that this woman who is now stuck in Florence. I’m pretty sure that’s her. Yes, “the foreigner who was the reason for her refusal to return to Khanzada, to my grandfather’s court, the reason for her removal from the record ...” (Rushdie, 2008, p. 213).

Carmen often asked herself **questions** or stated, “**I wonder.**” An example of **questioning** is, “By proper use of "Sunni-Uzbek potato-based spells it was possible to find a husband, chase up a more attractive love rival, or cause the downfall of a Shiite King” (Rushdie, 2008, p. 212). “Why not?” asked Carmen. “Potatoes can do all of that!” Carmen used **I wonder...** in the following way: “**I wonder** if that’s where they get Ismaili Muslims in the city of Marv.”

Carmen occasionally combined a few reading strategies. For example, she combined **summarizing, inferring, making text-to-self and text-to-world connections, synthesizing, and analyzing:**

At the top of 216, the princess goes back to India without her soldier, or soldier, without her sister... [**summarizing**] And since the sister didn’t come back and took her name off of all the historical record, which doesn’t surprise me actually [**text-to-self**]. There is a lot of stuff that suggests [analyzing and inferring] that there is [*sic*] a lot of amazing women that have been forgotten by women because their names have been removed from historical records by jealous men or horrible men [**synthesizing and text-to-world**].

Next is a quote that demonstrates three reading skills or strategies. Carmen showed (a) her curiosity, by stating, “**I wonder,**” (b) her ability to **infer**, and (c) her use of her **background knowledge** to make **text-to-world connections:**

... because some people from that part of the world tend not to be redheaded. That’s very much a northern European thing [**text-to-world**]. That’s why I’m curious about this redheaded thing, but **I wonder** if they are hot-blooded and violent [**inferring**]?

Carmen’s ability to **summarize** and **synthesize** is revealed as she **read quietly out loud** to herself:

So, he and Shah Ismail were kind of like they were being friends [**synthesizing**] ... So back in the italics ... For our grandfather's decision to send the Safavid ... So, this person, this mystery person, has shown up in Egypt and India and is telling the Emperor the story about this woman. And it turns out that the woman is their lost princess from years ago and they are, like, not only did she actually exist, but all of these decisions, like the way she acted, really influenced history. [**summarizing and synthesizing**]

Carmen **analyzed** the text and made **text-to-self** and **text-to-world connections**:

“A defeated god ceases to be divine” (Rushdie, 2008, p. 224). Yes absolutely. And we talked about this in class so many times [**text-to-self and text-to-world**]. That once your leader falls, your army becomes absolutely demoralized, and it becomes so much easier ... Look at the Battle of Hastings. Once he got that arrow through the eye, that was it. The Saxons were toast. I think they had bigger numbers or slightly bigger numbers, but they made some dumb mistakes and then that arrow through King Harold's eye was the nail in the coffin, to extend that metaphor. [**analyzing**]

Carmen demonstrated her ability to **wonder**, **infer**, and make **text-to-world connections**:

“Stamboul” I'm guessing [**inferring**] is Istanbul? There is a reporter on CBC [**text-to-world**] who is in Turkey, and she always pronounces it as Stamboul, so I'm **wondering** if that's the older version. I know that Istanbul is Constantinople in Byzantine ... and I **wonder** if this is more the Turkish version of Stamboul, the non-English version.

Finding humour in her reading was one of the skills or strategies Carmen used to keep engaged with the text. She laughed while reading, “He had fallen victim to the rarely used Great Uzbek Anti-Shiite Potato and Sturgeon Curse” (Rushdie, 2008, p. 212). In another place, she stated, “I love how he brings the guy's head with him in a jar—funny. That's awesome.” Her

humour was sometimes shown using **sarcastic comments** such as, “No, no it was the potato curse, though, not the guns, not the greater numbers. It was the potato curse.” Humour and sarcasm are indications of Carmen’s enjoyment of the text, which helps her with engagement.

Being a **curious** person, Carmen was willing to go beyond the text in order to fill in gaps from the text:

I’m interested to look at some of these borders to see where they compare to this. We don’t talk about Turkey—hardly at all—in history classes, so [it] would be interesting. I think a little bit more about it. I hear it’s a beautiful country. It might be a little bit scary to go to it now. I guess it depends on where in Turkey you go.

During the reading, she came across the word *qizilbash* and was curious about the meaning, but did not look up the definition until the end of the reading. Using self-scaffolding (Fani & Ghaemi, 2011), Carmen Googled the word and discovered:

So, the qizilbash is a label given to a wide variety of Shiite militant groups that flourish in Azerbaijan, Anatolia, and Kurdistan. So, these are in Anatolia because this is Turkey. The word qizilbash is Ottoman Turkish, meaning crimson or red-headed. The expression is derived from their distinctive 12-gourd crimson headwear. ... indicating their allies to the 12 imams and to Sheik Hadar ...

At another place in the think aloud, Carmen was **curious** and **questioned** herself, “Are those the ones that wear those pointy hats, who spin around? I’ll have to look those up. I saw them on TV once, and I think that’s what it is. Those Sufi mystics.” She was willing to go beyond the text to expand her knowledge of the information gathered in the reading.

The Mathematics Teacher. Interestingly, Gosset, the participant who viewed herself as a poor reader, used the most reading-specific nonvernacular social languages (Gee, 2014). Being

a weak reader as a child, Gosset had needed to consciously and repeatedly employ strategies that slowly enabled her to become an accomplished reader of Master's level texts. With regard to reading math texts, Gosset explained:

I'm the kind of person that as I'm reading through the mathematics itself, I've got to figure it out; otherwise, nothing else makes sense. That's the idea behind mathematics, is that you have a base and then you move forward and if you don't get the base then you can't move forward.

For this participant, I analyzed two think alouds. The most challenging text was Gosset's second think aloud, *The Guinness brewer who revolutionized statistics* (Kopf, 2015). Gosset chose this article to get information for a paper about William Gosset that she was writing for her class. Compared to the other texts Gosset chose, it had the least amount of math in it, requiring Gosset to use her English reading skills more than her math reading skills. That said, it still had discipline-specific concepts. Gosset was able to show her ability to read and understand these concepts. The other texts she picked consisted more of math problems or proofs, which she did not find as demanding. In order to demonstrate how Gosset engaged with a more math-heavy article, I also analyzed "The Algebraic Aspect of *La Géométrie*" (Burton, 2013), Gosset's first think aloud. Gosset completed the problems in her first think aloud enthusiastically; she examined the proofs in detail and went back to reread any troubling passages.

As Gosset engaged with her most arduous text (Kopf, 2015), she demonstrated many literacy practices, such as making connections, analyzing, synthesizing, inferring, predicting, and self-monitoring. She was much more comfortable working with texts that use non-alphabet ideographs rather than alphabetic symbols (Goodman, 1996). Gosset read much of the article using **mumble reading** and **private speech**, which helped her in her thinking. She explained that

she gets herself alone somewhere—often in her backyard—and “hashes through” pieces of reading out loud. Gosset required the verbalization and the hearing of her thinking as well as the seeing of the words on the page to make sense of the text. Even as she wrote notes to help with her comprehension, Gosset spoke quietly using **mumble reading**. Her understanding that she knows when to vocalize her thinking reveals her **self-monitoring** skills. Like Carmen, Gosset verbalized many connections (over 50) to the text, which were mostly **text-to-self** and **text-to-world connections**. These connections reveal Gosset’s vast **background knowledge** and her ability to apply that knowledge to her reading. Many of the quotes I use as examples of Gosset’s text engagement are longer than the quotes of the other participants, as I lack the mathematical and statistical understanding to summarize or paraphrase her explanations. I wanted her words to speak for her.

Most of Gosset’s connections were **text-to-self connections**, with a few **text-to-text connections**. One **text-to-text connection** is: “I know who Thomas B. Case is. He is the chemist I have read about.” She was aware of the information she had learned from other places that connected to what she read in this article. Of the many **text-to-self connections**, here is one example:

I feel like the very last sentence on the first page [that] says, “How did a brewer of dry stout revolutionize statistics?” (Kopf, 2015, p. 1) is exactly what I’m trying to read and write about for my paper, so the question itself answers what I want to talk about.

Gosset made a few **connections** to her classroom, including when she stated, “My Grade 9s or Grade 10s could read the curve.”

Many of Gosset’s **connections** reflect her interest and enjoyment of the text. For example, in the following quote, Gosset needed to **analyze** and **evaluate** the information in order

to make **text-to-self** and **text-to-world connections**, and doing so demonstrated her enjoyment of reading the text:

I like the idea of a “scientifically minded company” (Kopf, 2015, p. 4), even though it was a brewery; today it would be about scientifically minded companies. We automatically go to engineering companies, and I automatically go to Google or computing science companies. ... But I [didn’t] think of that until now, until I started doing this research now.

I like that. It’s kind of interesting. It makes me think that could be a field I could go into.

Gosset was interested in the content, efferent (Rosenblatt, 2013), for the purpose of writing her course paper, but she was aesthetically (Rosenblatt, 2013) invested in the reading as well.

Interestingly, Gosset often combined her connections with other reading skills, strategies, and thinking processes. In the following quotes, she used **inferring**, **analyzing**, and **making text-to-self connections**. “When I read, “pretty awesome guy” (Kopf, 2015, p. 2), I think that the author is probably going to be an easy read [**analysis and inference**]. I feel like this is being written for readability, not necessarily going in-depth, so there is cautiousness there [**text-to-self**].” Gosset also demonstrated **text-to-self connection** and **analyzing**:

When we look at the distributions just for a quick second ... The z -distribution and the standard normal distribution is the tallest curve. Not necessarily what I would’ve said [**text-to-self connection**]. I think the middle curve would’ve been more [of a] standard normal curve. The t -distribution for the sample size n is represented closer to 30, so it’s off from what they’re claiming as the actual z -distribution and then the t -distribution, the value that is smaller, looks like a semicircle or an oval [**analysis**].

In another instance, when referring to the text (Kopf, 2015, p. 4), Gosset **evaluated**, **synthesized** and **analyzed** information and used a **text-within-text connection**:

It doesn't look quite like a bell curve at all, and that's when it got to have smaller sample sizes. So, you can clearly see that they're trying to estimate the value closer to one of those two ends, that there is a dramatic difference between those three lines [**evaluated**]. There has to be some accuracy problems, which is what we're talking about, consistency at the top here with how accurate your estimates [are], and now we've done it twice now [**synthesizing** and **analyzing**]. Paragraph two talks about the consistency of hops across the batches with the difference between 8.1 percent and 8.4 percent and then later on, in paragraph four [**test within text connection**], it talks about the accuracy of their estimates.

As well, Gosset combined **synthesizing** and **self-to-text**:

I love the fact [**self-to-text**] that it says, "a bit of math" (Kopf, 2015, p. 4) and "less scared" (Kopf, 2015, p. 4), because he [Gosset the topic of the article] actually had a degree in math. His first degree [was] in math, the second in chemistry. So, study a bit of math if you like—that's an understatement [**synthesizing**]. I have no idea why people put "less scared" (Kopf, 2015, p. 4) in quotation marks. Math is not scary. It kind of actually makes me feel a little bit itchy when people talk about math in a negative connotation.

At times, Gosset showed **predicting**, **self-monitoring**, and **text-to-self connections**:

I don't know if I understood [**self-monitoring**] "liberal license to innovate and implement their findings" (Kopf, 2015, p. 3) until I read the next part, but it sounded really interesting, and now I'm like, yes, that's confirming what I thought [**predicting**] would be a very good place to work [**self-to-text**].

Gosset often **analyzed** and **synthesized** information, and in the following example, she also **paraphrased** and demonstrated **self-monitoring** by using **mumble reading** to clarify understanding:

Sorry, I **read this part out loud**. This is [the] last paragraph on the third page. “At the scale at which Guinness was brewing, the ‘looks and fragrance’ method was not economical or even accurate. The scientific brewing team, of which Gosset was a part, would improve this selection process” (Kopf, 2015, p. 3). So, to me, I think in this last paragraph, it is saying that things weren’t going well. It was not economical or even accurate to use methods that were previously used for years and years. There must be a change that was required, and he was a part of that change [**analyzes, synthesizes, and paraphrases**].

In order to paraphrase, a person would need to analyze and synthesize the information. In the next example, Gosset did that, and then applied and questioned:

Calculating ... quality of hops determined by calculating proportion. These are all mathematical. Determined, calculating, and proportion are all mathematical terms. ... [**analyzes, synthesizes, applies**]. I’m going to write that as a fraction ... soft resins [**analyzes, synthesizes, applies**] What did I say? [**questions**].

Gosset effortlessly moved from the alphabetic (letters) to the ideographic (numbers) by writing soft resins as a fraction. She moved fluidly between the two meaning-making systems, which is an example of her use of transliteracy.

Like other effective readers, Gosset often read the text, **analyzed** what it said, **synthesized** it, and **applied** the information:

A parameter of the entire population and a statistic is only used for a sample size, and so a statistic. And then add or subtract a particular margin of error to it, and so you would get an interval, what we call a confidence interval. So, that must be what he’s talking about, the wider error distribution. ... He is probably going to have, or maybe he hasn’t termed it

margin of error just yet, or maybe it's the author's use of the words here so far, but that the margin of error must be larger, so instead of going from 1 to 2 it must be going from 0.5 to 2.5, because that's the wider gap.

Here again, she follows a pattern in her engagement of the texts that included **analyze**, **synthesize**, and **apply**. The pattern is a reliable strategy for her.

One of the reading strategies Gosset knew she used often was **paraphrasing**. She demonstrated this many times throughout her think aloud:

Then he switched it to a smaller sample, the two-observations samples, so from large numbers to two observations samples from the same thing, so he did a huge simulation and found the numbers, so he was very competent in his population parameter.

Gosset **paraphrased** an explanation of visual representation in the text:

This is a nice visual that shows that accuracy is important here, as you were talking about an average size being smaller or larger on the scale, and even in the middle, it's dramatically different. The only times where it becomes closer to anything [is] when it comes close to zero, and that's not useful information.

Not only did Gosset **paraphrase** as she read—she stated she often used **paraphrasing** as she taught.

Summarizing was also implemented in Gosset's text engagement; for example, in the following quote, she summarized the sweetness of the samples, stating:

133° of sweetness, but I'm allowed to go plus-or-minus .5, which is really my confidence interval is what I'm saying, and I want to go between 132.5° to 133.5° in order to feel confident that my beer is going to taste good.

There were times when she combined **summarizing** with **analyzing** and in the process made **connections to herself**, for example:

So, 80% of the time from just two observations, and that's not bad. So, 80% of all the times that he did this [he] was within 132.5° to 133.5° from within the true number, based on his large samples. I really like the fact [of] proper methodology in his scientific approach to it.

Being a curious person, Gosset used **questioning** and stated, "**I wonder...**" several times, for example, in the following quote, using multiple sign systems to make meaning, she constructed a visual image of possible hop shapes in her notebook. In illustrating what she is reading, she questioned herself:

Oh, maybe. That's interesting. Soft resins to hard resins ... In a batch, it means this will be in a batch. The resin is "a semisolid substance that comes out of the glands of hops" (Kopf, 2015, p. 4). Grand. I'm going on a science tangent, but [it's] in order for me to understand what he's talking about. I would assume that I don't know why I think hops are circular; I think they're like this; they are more of a shape of the wheat. Are they not?

Gosset sometimes **asked a question**, made a **text-to-self connection**, and then **analyzed** and **synthesized** the information in attempting to answer her question. For example, as she reread a section, she explained:

I'm trying to calculate this is the problem by dealing with malts. So, are they two separate problems, or is this the means to the end? [**question**] For me, when we're talking about trying [to] produce the most consistent quality of a product [it] always stems from what you are actually putting into your product [**text-to-self**]. You would want to have the quality of your raw materials in order to get the quality of your end product, especially in

the early 1900s, so then I don't understand the difference between that [**analysis** and **synthesis**].

Next, in the following quote, when discussing “small number of samples” (Kopf, 2015, p. 4), Gosset **questioned** the text against what she already knew (**text-to-self** and **text to world**) and showed **self-monitoring**:

I am already aware that Gosset was trying to create statistical tables on small sample sizes [**text-to-self** and **text to world**]. So, when we talk about small number of samples, does that mean small sample sizes, or you only took samples from one or two batches? If there were 10, there are thousands there, so I don't know what a small number of samples [means] from this author [**self-monitoring**].

Referring to the bottom of page 4 and the top of page 5 (Kopf, 2015), Gosset showed **self-monitoring** by **asking out loud** “**I wonder...**”, and **questioning**:

I wonder why you would choose 2 or 10? But I guess it wouldn't matter. Two or 10 is relatively small when you're talking about a sample of a thousand. How much wider is the error of distribution of an estimate? [**questioning**] To me, that is the definition I'll have to think about [**self-monitoring**].

When referring to “industrial settings” (Kopf, 2015, p. 4), Gosset revealed **self-monitoring** and **text-to-self** and **text to world connections** and found three things interesting in the paragraph that referred to “industrial settings:”

To me [**text-to-self**], the whole purpose of Guinness setting Gosset off with this work [was] so that we could have industrial settings, or the math being applied in everyday life, and not theoretical. So, these industrial settings think about the factory, and I think about the physical hops, and I think about the barrels of beer, and for some reason, metal comes to

my mind. I think that is because I've seen some of the images of the Guinness factories nowadays, and not the way it used to be, but when I think of industrial settings also metal and industrial come to my mind, but this is to me [**self-monitoring**] the practicality of what statistics is [**text to world**]. It's the most applicable math.

In making the connections, Gosset also moved across time in her thinking, comparing what it might have been in past times to now.

Another **self-monitoring** example is that Gosset would **reread** information she did not understand. As she **reread** the piece, she tried to explain the meaning to herself and then questioned what she read. She reread the following “and remains highly depended upon by those in academia and industry” (Kopf, 2015, p. 6) and then stated, “the “student’s t-distribution... the primary way to understand the likely error of an estimate.” So, that’s the confidence interval, “depending on your sample size” (Kopf, 2015, p. 6), that was the problem at hand. Now we can take it into consideration.” She then **questioned** what she read, asking, “but I don’t know why that remains highly dependent on those in academia and industry? Why is it even relevant?”

Gosset **wrote in her notebook** to clarify ideas, do the math, or take notes, which she would clarify later. For example, “Error distribution. I’m just writing that off to the side because I feel like that’s one of those things I don’t quite understand, and I probably need a better grasp of it before I can move forward ...” When she recognized it was necessary for her to write in her notebook, that was another example of **self-monitoring**.

Gosset was very aware of and confident in her **background knowledge**, and expressed her awareness of it several times throughout this think aloud. For example, she stated the use of her **background knowledge** when referring to z and t scores, test statistics, variances, and hypothesis testing, as well as Fisher’s biology background and his views on experimental design.

She would introduce her use of background knowledge by saying “so that’s a little bit of **background knowledge**,” or “This is just going to **some previous knowledge**,” or “I’m just accessing some **background knowledge**,” or “this is **some of my background knowledge**.”

Gosset even **fact-checked** the information in the article once, stating, “This is not true. I don’t think it was Columbia University. It was at London University. That’s a little factoid. I’m going to look at that later on cross-reference.” She was not afraid **to go beyond the text to find more information**. Gosset’s strong background knowledge and **math ability** made the reading much easier for her to comprehend.

In the process of trying to understand the **meaning of unknown vocabulary**, Gosset asked **questions** such as, “What does saccharine mean?” She would then go to Google (**self-scaffolding** (Fani & Ghaemi, 2011) to find the definition. Another unfamiliar word was sanctification. Gosset stated, “I can’t even say it—sanctification. Is it like justification? I don’t understand.” She then Googled the word and found the definition. Her recognition that she did not know words and then looked them up demonstrates her **self-monitoring** skills. To Google something is a literacy practice that has emerged because of the availability of Google.

Gosset was aware of the **text features**—bell curves and tables—used within this text. When referring to the bell curve (Kopf, 2015, p. 4), Gosset **synthesized, analyzed,** and used **text-within-text connections**. The complete quote shows **synthesizing** and **analyzing**, and the second half of the quote shows **text-within-text connections**:

It doesn’t look quite like a bell curve at all, and that’s when it got half smaller sample sizes, so you can clearly see that they’re trying to estimate the value closer to one of those two ends, that there is a dramatic difference in between those three lines. There have to be some accuracy problems, which is what we’re talking about, consistency at the top here [**text-**

within-text connection] with how accurate your estimates are, and now we've done it twice. In paragraph two [**text-within-text connection**], it talks about consistency of hops across the batches with the difference between 8.1% and 8.4%, and then later on in paragraph four [**text-within-text connection**], it talks about accuracy of their estimates.

Gosset gave a detailed explanation of how she read “the original *t*-distribution table from Gosset’s seminal work” (Kopf, 2015, p. 6). This table in the article was difficult to read, but Gosset was familiar with it and had a copy of it on her shelf. When asked how she would read this graph if it were the first time she saw it, Gosset explained that she would look at it and figure out what the equation was representing. She was familiar with this genre (Halliday, 1985; Goodman, 1996) with its certain constraints and forms:

I can tell you what I think this graph says even though it’s a bit messed up. I see that there is a constant in front of an integration, and I see that I’m going from negative infinity to some value of x , and then I’ve got some function of eight to the power of negative $7x$ squared over dx , so I know this is calculus. This is what I was talking to you about on the previous page [referring to the bar graph]. This is physically what that curve look[s] like; if you were to actually graph in a graphing calculator to a table of values, x equals one, what is y equal to? x equals two, what is y equal to? [It] go[es] back to the basics—Math 8, Math 7, Math 6. ...

Once she understood the shape, she tried to figure out the values. She figured out what was her input. Gosset recognized that the graph is “a little bit messy,” but in order to understand it, she would “look at the input versus my output.” She had “two input[s] that I required for one output, so that's how I go about reading it.”

After the think aloud, Gosset was asked how she reads graphs in general, to which she replied that it depends on the graph. If she is looking at a calculus graph, she looks at “ x -intercepts and y -intercepts. I’m looking at are there any asymptotes? What are the non-permissible values? Those kinds of things.” If she was reading a statistical graph, she is “looking at the shape first. I don’t need to know x -intercepts and y -intercepts, and I don’t need to know maximum points. I want to know the area under the curve.” She continued with her explanation of how she reads a graph genre (Halliday, 1985; Goodman, 1996):

Ironically, calculus and all those things I described, relate directly to how these curves are formed ... in the actual integration of a function, so these are functions in themselves. But in statistics, we don’t look at the function. The function for normal distribution is this long, and you have to have a six-year math student do the integration. My Grade 9s or Grade 10s could read the curve. So, in statistics, when I look at this, I look at the shape of the graph, so I don’t know if that clarifies. But it’s also important to recognize what type of graph it is. Is it a statistical graph, or are you actually looking at a function?

Gosset found the Kopf (2015) article, which is biographical with some math concepts, to be the most difficult, demonstrating the greatest number of literacy practices. She found reading equations (non-alphabet ideographs) (Goodman, 1996) easier than reading the alphabetic symbols (Goodman, 1996). To show how a math discipline-specialist engages with a more mathematics-focused text, in this section I give examples from portions of Gosset’s first think aloud, “The Algebraic Aspect of *La Géométrie*” (Burton, 2013). This was the first time Gosset had seen this particular proof by Descartes. As Gosset engaged with this math-heavy article she demonstrated many non-vernacular social languages, including self-monitoring, making connections, engaging background knowledge, prediction, and questioning.

Gosset chose this article as it was required reading for her Master's coursework. They were learning about Descartes, a French mathematician who was the first to introduce analytic geometry. This article was translated from French. Gosset explained that Descartes looked at his current math practices and at "how math was done for a couple hundred years" prior to his time (c. 1637). Descartes' math practices revolutionized "the way the proofs are done." Gosset further explained that today's mathematicians do not look at proofs the way mathematicians did 300 years ago. The proofs are mathematically the same but are interpreted differently, using different symbols. According to Gosset, Descartes put forth one of the main approaches that bridged the mathematical gap between then and now. In describing the impact Descartes had on mathematics, Gosset demonstrated her use of **background knowledge**, particularly **text to world**.

Gosset found the Descartes proofs difficult, and had hints from the assignment to help with her understanding. Gossett stated that the assignment asked her to "read pages 373 to 374, where he solves the quadratic equation, and now I have to go ahead and solve this quadratic equation using this method. But it gives me this hint [in the assignment]." From the assignment, Gosset realized that understanding the proof would be difficult; this eased her discomfort with her own struggle. She stated, "I know that I struggled here a little bit, but I was able to go back to figure it out."

Gosset explained her use of **background knowledge** when referring to the second mathematical line in the proof (Burton, 2013, p. 37). She stated that she knew what the product of two quadratic is supposed to look like to get to that quadratic function:

so I understood where these are coming from and I didn't have to do the proof of it; I also didn't to do the expansion because I know that it is just multiplying each one of these

terms out and collecting like terms; to do this is going to be 1, 2, 3, 4, 5, 6 [or] 2,4, 6.

There will be 3, 6, 9, 12 different terms. I would have to expand them all out and then combine them all. And it would take half a page. I know how to do it and that's why I can skip it.

The article required a vast background knowledge in order to understand its content.

As Gosset began reading the text, she stated that she needed to “pay particular attention to the proof” (**reading focus**). Gosset first **scanned** the reading and immediately recognized all the mathematical symbols used in the article (**background knowledge**). She recognized polynomial functions and stated, “This looks like any polynomial function, and some roots that look like some answers with some radicals at the end, and then it looks like it goes into general form.” As she read, Gosset interacted with the text using **square brackets, underlining, circling, or boxing** to highlight important texts. Furthermore, she used **annotation** to give herself further clarification or explanations, as well as to question the text. She annotated writing out math problems or words into symbols or equations. In addition, Gosset **jotted notes** and **completed math problems** and **drew diagrams** on a **separate sheet of paper**, which Shepherd and van de Sande (2014) state are strategies that expert math readers do. Gossett was intent on going through the necessary steps to understand the math. She used a **calculator** to check her work.

Consistently, Gosset **translated the math symbols into words**, or what Shepherd and van de Sande (2014) refer to as “reading-the-meaning” (p. 78). For example, when Gosset reads $f(x)$ she states, “the function,” knowing the significance of $f(x)$. Another example is $f(-x)$, which happens to be a reflection on the y-axis. When trying to understand $(z^2 + kz + m)(z^2 - kz + n) = z^4 + (m + n - k^2)z^2 + k(n - m)z + mn$ (Burton, 2013, p. 37), Gosset explained “So I got my two

quadratics; if I expanded these out, I would get ‘this times this,’ which is that, then you get ‘this times all of that’ which [is] just another lead coefficient of z^2 plus ... z , plus the constant at the end.”

Gosset also used **self-monitoring** as she read. She found that the time that elapses between the onset of frustration and her awareness of the frustration was short, and she began fixing her lack of comprehension by using various literacy practices. Concurring with Shepherd and van de Sande’s (2014) explanation of what expert readers do when they read, Gosset spent much time trying to understand the text. For example, it took her over five minutes to read the first two paragraphs of the text because she wanted to ensure she understood the complexity of Descartes’ thinking. Gosset was aware when she needed to **reread** portions; when she was not understanding the math, Gosset stated, “I’m just writing ‘upper bound to the number of its positive roots,’ because I didn’t understand it, but now I think I get it.” This also demonstrated her self-monitoring. Gosset also noted, “... because it wouldn’t make sense. I don’t know enough, so I’ll have to come back to this one. I have to think about that.”

A few times she used the self-monitoring thinking process of **coming back** to a puzzling section so she could think further about it. She would often work out the math concept on a sheet of paper until she understood what Descartes was explaining. Gosset used the **oral reading** self-monitoring tool to aid in comprehension. She also went back a number of times to check her work and help her understand Descartes’ ideas. Once Gosset understood the text she would sometimes verbalize, “Okay, got it!—I get that!” Or she would place a check mark beside the text or equation she was reading. For example, $z^2 + 4z + \frac{1}{2}(16-17-20/4) = 0 \checkmark$. If Gosset was not understanding something, she knew when to take a break and continue on to a different concept.

Gosset demonstrated another effective reading strategy in her use of **prediction**. For example, she stated,

when he is going to get down to his proofs later [in the text], I will probably want it in this format if that's what he's asking for... I'm going to guess ... when he eventually does a proof, he is going to have to put [it] into a number of factors.

These are examples of **predicting**.

Gosset made **text to self** and **text to world connections** when she explained, “This is what I would teach [referring to the math she has calculated on a separate sheet of paper] so I feel comfortable with these things.” **Text within text connection** was made when Gosset stated, “That's what we were talking about earlier.”

Gosset used **questioning** when she asked, “It's limiting how many positive roots there would be, but I don't know why he wants to do that?” and “Why can't it be equal to?” Gosset asked “What?” after she read “This equation, having only one sign [change] ...” (Burton, 2013, p. 37) and then tried to make sense of it by saying,

So, we go from a negative to positive to a positive. This says 2 and this says negative; negative to a positive. This says 2 but this says positive positive—and this says one ... $x^6 - 10x^2 + x + 1 = 0$ it is either 2 ... or none Two sign changes.

Gosset then went through a number of equations on a separate sheet of paper trying to understand what Descartes was thinking (**self-monitoring**). She said, “**I wonder** ...” a few times. For example, Gosset queried, “I wonder why he's got an a there? That's so strange.”

As Gosset read “Comparing the coefficients in the two forms of the equation” (Burton, 2013, p. 37), she demonstrated her **background knowledge** by describing her thinking:

We don't care about anything other than the coefficients, so then I'm going to take my p value and in front of my z^2 and equate it to $m + n - k^2$. My q value here and equate it to k multiplied by. This is what he did in the last one equating... He equated coefficients. Okay then I get the r value but don't care about the lead coefficient because the lead coefficient itself has just got a one in front. If k is not allowed to equal to zero, the first two can be reduced by isolating for $2m$...

Gosset has the background knowledge to understand variables and various vocabulary.

When reading the text, Gosset would often first **skip** over the words and go to the equations, stating that she understands the math better than the words. For example, she read the equation $f(x) = a_0x^n + a_1x^{n-1} + \dots + a_{n-1}x + a_n = 0, a_0 > 0$ (Burton, 2013, p. 36) and then went back and read the words that led up to it. Gosset explained that “‘each root counted as often as its multiplicity’ [(Burton, 2013, p. 36)] means you can have the same factor more than once. It doesn't necessarily have to be that. I could put this with the power of n here; the number of positive roots with the equation.” This also demonstrated her ability to **orally** explain the meaning of mathematical phrases.

Gosset **summarized** when she read “the equation $x^3 + x^2 - x + 2 = 0$ has either two positive roots or none, the exact number not being found by Descartes's rule. The two roots may coincide ... neither is repeated” (Burton, 2013, p. 36). She then summarized, stating, “So either two distinct, when repeated, or none at all. That's what I think this rule is stating.”

There were times in the reading where Gosset **analyzed** specific wording that was used which she did not like. For example, she stated, “I don't like the word “or” in mathematics.” Another example is, “imaginary roots [imaginary numbers] we don't like.” She explained:

It's [imaginary numbers/roots] not a part of the real number system. Meaning it's not something we would use in the context of high school. It's beyond that scope. Because I'm not as comfortable with it, I always feel imaginary numbers are very abstract.

In the analysis, she made **text to self** and **text to world connections**. She also used **synthesizing** in various places, for example, "So, you have to add that piece of information that is an element of the reals, which is mostly what we work in anyways."

Even though Gosset views herself as an auditory learner, the use of **kinesthetic** behaviours also assisted her in her comprehension. For example, when referring to left-hand, she lifted her left-hand with the thumb and index finger making an L. Deciphering the math on a note pad or taking notes could also be considered kinesthetic examples.

Throughout this mathematical text, Gosset was able to comprehend due to her use of various thinking processes and reading strategies, such as self-monitoring, summarizing, questioning, and her vast background knowledge. She had the necessary perseverance (Shepherd & van de Sande, 2014) to complete and understand the reading. Gosset used many of the same literacy practices to read the Descartes (Burton, 2013) article as she did to comprehend the Kopf (2015) text. Because Gosset prefers to engage with non-alphabet ideographs (Goodman, 1996) rather than alphabetic symbols (Goodman, 1996), she found the Kopf article more difficult. Gosset successfully engaged with both texts because of her mathematical thinking expertise. Concurring with Shepherd and van de Sande's (2014) summarization of expert math readers, Gosset was aware of her comprehension and performed frequent, multiple self-monitoring checks.

In summary, all the participants were curious learners who had the perseverance to continue reading, even though their texts were difficult. They were willing to go beyond the text

to get a greater understanding of the text. Sometimes going beyond took place during the read or was something they planned on exploring later. Each of the participants was intrinsically motivated to continue with the reading, even when the reading was difficult.

Appendix P shows the reading-specific nonvernacular social languages (Gee, 2014), that the participants used while reading what they considered their hardest discipline-specific texts. The majority of these literacy practices are content-based literacy practices which were used to read the discipline-specific texts (Di Domenico et al., 2018), but the literacy practices were often applied differently for each discipline. Content literacy strategies exist that are foundational to discipline-specific literacy practices (Dunkerly-Bean & Bean, 2016). Each participant exercised various literacy practices; some were unique to the individual participant, while with others there was an overlap of skills and strategies that all four participants employed. The four outer boxes contain the strategies used by the participants as they read their most difficult texts. Within the four boxes, strategies that have an asterisk beside them were used by three out of four of the participants. The middle box contains the common literacy practices employed by all four participants; I bolded every second practice to differentiate them.

Interestingly, Elizabeth, Carmen, and Gosset used many similar reading strategies, whereas Goodall did not. This could be because the text contained much information that did not fit into Goodall's background knowledge. Corresponding with Moje et al. (2010), she was able to comprehend the text using her reading skills, strategies, and thinking processes, but she could have gone deeper if she had been able to apply some background knowledge.

Differences Between Literacy Practice Cognizance and Actual Use

I noted discrepancies between the literacy practice nonvernacular social languages (Gee, 2014) that the participants, in the preliminary interview, said they used (Table 3, p. 135) and

what they actually used while reading. The literacy practices used include reading skills, strategies, and thinking processes. To support that their literacy practice use was automatized (Godde et al, 2020; Rawson, 2010; Kuhn et al., 2010; Bodrova & Leong, 2007; Gal’perin, 1969), all four of the participants used more literacy practices than they had listed in the preliminary interviews. They were not aware of all the literacy practices that they used. Table 4 contains a summary of the nonvernacular social languages the participants used but did not articulate in the pre-think-alouds interview. The table displays common practices as used by all four participants, by three participants, and by two participants, as well as uniquely used literacy practices.

Table 4

Literacy Practice Nonvernacular Social Languages Used, But Not Articulated, in the Pre-Think-Alouds Interview

Literacy Practice Utilization	GOODALL Science	ELIZABETH SS	CARMEN ELA	GOSSET Mathematics
Literacy Practices Used by All Participants	<ul style="list-style-type: none"> • text features • organization awareness • resiliency 	<ul style="list-style-type: none"> • text features • organization awareness • resiliency 	<ul style="list-style-type: none"> • text features • organization awareness • resiliency 	<ul style="list-style-type: none"> • text features • organization awareness • resiliency
Literacy Practices Used by Three Participants	<ul style="list-style-type: none"> • private speech • making connections • mumble reading • self-scaffolding • perseverance 	<ul style="list-style-type: none"> • making connections: • questioning • perseverance • intrinsic motivation 	<ul style="list-style-type: none"> • private speech • making connections • mumble reading • self-scaffolding • questioning • intrinsic motivation 	<ul style="list-style-type: none"> • private speech • mumble reading • self-scaffolding • questioning • perseverance • intrinsic motivation

Literacy Practice Utilization	GOODALL Science	ELIZABETH SS	CARMEN ELA	GOSSET Mathematics
Literacy Practices Used by Two Participants	<ul style="list-style-type: none"> • skipping • predicting • background knowledge • curiosity 	<ul style="list-style-type: none"> • skipping • curiosity • paraphrasing • summarizing • going beyond text to understand text 	<ul style="list-style-type: none"> • paraphrasing • summarizing • inferring • recognizing own purpose for reading 	<ul style="list-style-type: none"> • predicting • background knowledge • inferring • recognizing own purpose for reading • going beyond text to understand text
Unique Literacy Practices	<ul style="list-style-type: none"> • skimming and scanning 	<ul style="list-style-type: none"> • looking forward and back in text 	<ul style="list-style-type: none"> • giving antecedent information • finding humour (sarcasm) • understanding allusions • annotating 	<ul style="list-style-type: none"> • synthesizing • analyzing • drawing • editing • finding meanings of difficult words: via dictionary, Wikipedia, morphemic analysis

While reading her most challenging text, Goodall not only used the literacy practices she was aware that she implemented, but also used several others as pointed out by the researcher (Table 4). She skipped parts, as well as skimmed and scanned as she read. Goodall made predictions about what was going to be in the article. She used text features of this specific genre (Halliday, 1985; Goodman, 1996)—pictures and tables—to gain a more in-depth understanding of the written text as well as being cognizant of article organization. Goodall used her background knowledge or personal associations to support her understanding by making connections. Furthermore, she read using private speech. Goodall's curiosity about the subject matter motivated her to want to continue reading. In addition, perseverance, resiliency, and intrinsic motivation were elements of Goodall's reader profile.

While reading her most difficult text, Elizabeth also used several literacy practices beyond what she had stated in the preliminary interview. Elizabeth paraphrased, summarized, and questioned. She looked forward and back in the text, as well as skipping ahead when she found the information not useful. She also used mumble reading. Elizabeth was aware of and utilized her knowledge of text genre (features and organization) (Halliday, 1985; Goodman, 1996). She was willing to go beyond the text to understand what was being read. To clarify, during the preliminary interview, Elizabeth had said that delving deeper and deeper into the text enabled greater understanding and gave her more than the general gist. It filled in knowledge and fact gaps. I deduced that she meant she was applying newfound knowledge and synthesizing the new information through using her background knowledge. Gee (2002) explains that particular language, which he refers to as Discourses or nonvernacular social languages (Gee, 2014), is used in specific situations. Elizabeth did not have the nonvernacular social language to label, specifically, what she did as she read. She was aware that she used her background knowledge

but did not voice when she was making specific connections to text, world, or self. Her curiosity and intrinsic motivation to learn about the subject spurred her desire to learn about this subject. In addition, Elizabeth displayed reading perseverance and resiliency as she engaged with this text.

As with Goodall and Elizabeth, Carmen used more literacy practice nonvernacular social languages than she had identified during the preliminary interview. She summarized, paraphrased, inferred, questioned, annotated, gave antecedent information, and, at times, used mumble reading. Carmen was aware of allusions. Furthermore, she used her understanding of text genre (Halliday, 1985; Goodman, 1996) by recognizing text features and organization as she read her most difficult text. She recognized her purpose for reading. Carmen also displayed curiosity and her sense of humour; these seemed to be a part of her intrinsic motivation. To clarify, during the preliminary interview, Carmen had stated that she problem solved as she read. I deduce that problem solving refers to synthesizing, analyzing, and application of knowledge. As well, she stated that she uses prior knowledge, but she did not state that she made connections with this knowledge.

Gosset also implemented more literacy practices than what she had described during her preliminary interview. While she was aware of her reading skill, Gosset did not state that she inferred, synthesized, analyzed, applied knowledge, questioned, or predicted. She looked up difficult words using Google and was willing to go beyond the text to understand other aspects of what was being read. Gosset was aware of the text, and edited places that were not correct. She drew pictures to solidify her learning and employed her understanding of genre. She recognized her purpose for reading. To clarify, Gosset did not state that she had discipline-specific background knowledge, but she related her background knowledge in general terms. She

stated that she made connections but was not specific as to what connections she made. Like the other three participants, Gosset had an intrinsic motivation that added to her reading perseverance and resiliency.

The Final Think Aloud

When selecting a text for all the participants to read, I wanted the text to be related to disciplinary literacy and the practice of teaching, but also to be general enough so that all four participants could relate to it. The Springer et al. (2014) article, “Ready or not: Recognizing and preparing college-ready students,” met these criteria. The main reason for my choice was that Springer et al. gave examples of literacy strategies as applied to the disciplines. Therefore, the examples in it would be relatable and potentially valuable to the participants.

After the teacher-chosen text think alouds, for the last think aloud I chose the same text for all the participants. My thinking was that by performing the prior four or five think alouds and having had the various pre- and post-think-aloud discussions, the participants would have enough experience and background knowledge to interact with the Springer et al. article. This article discussed four essential skills that students require in order to be prepared for college-level reading, featuring examples of what reading readiness looks like in high school seniors, and teaching approaches to help students become college-ready. The four skills that Springer et al. identified were: (a) reading complex texts strategically and independently (p. 301); (b) close reading (p. 302); (c) synthesizing ideas across multiple texts (p. 303); and (d) reading stamina and wide reading (p. 304).

As I had hoped, the practice of the prior think alouds did prepare the participants to communicate metalinguistic awareness. Each of them was able to communicate thinking more effectively. Goodall used many more text-to-self and text-to-world connections throughout the

article than she had used in reading her most difficult text (Lin et al., 2017). In addition, Goodall made more “I wonder” comments and asked more questions, and displayed evidence of applying, evaluating, synthesizing, and analyzing. One of the reasons for the increase in these reading strategies could be because of the article’s teacher–practice focus. Goodall could easily engage with the text and apply it to her life.

Even though I recognized the strategies Goodall was using, she did not use nonvernacular social language (Gee, 2014) to explain her thinking. Goodall did not say she was making connections, analyzing, evaluating, inferring, or applying knowledge when she used these strategies. Goodall used the synthesize, analyze, and apply reading cycle when reading this article. As well, before she began this think aloud, I had asked her about her use of visualization and whether she could tell me when she visualized. She enthusiastically confirmed that she visualized. Goodall informed me, “Probably the fastest or easiest link is if I ever said, ‘this makes me think of’—I’ve already made a link. I already have a picture in my head.” When reading her most difficult text (see Appendix P), Goodall did not use the strategies of analyzing, evaluating, inferring, or applying knowledge that had been used by the other three participants (noted with asterisks). Goodall, however, used these strategies when reading the Springer et al. article, which could be the result of having strong background knowledge.

This article lacked math examples. When I apologized to Gosset for this omission, her reply was quite interesting. She explained that from her viewpoint, teachers do not like to write about math. Even Gosset, who is an accomplished mathematician and statistician, felt writing about math to be the “most nerve-racking thing to do.” She could write for her history course about historical math, but if she had to give math examples, she was very intimidated. She believed that many math teachers consider writing math examples to be a daunting task because

“somebody else is reading it and writing it, and it’s not about your opinion. If this number is not in the correct spot, everything else is wrong ...” Gosset explained that because of the feeling of intimidation, math examples given in various texts pertain to elementary or junior high math.

Each participant found the article interesting and useful (including Gosset, even though math examples were not included). As with the other texts read by the participants, the expectation was that they would read five pages of this article. Goodall explained that she wanted to continue the article and could recognize in the vignettes various students she teaches or has taught. She liked that the article gave specific examples of college-ready or not-ready students. Because Goodall and Elizabeth are in the same school, Goodall was looking forward to discussing this article with Elizabeth once Elizabeth had completed her think aloud. Elizabeth stated that the article gave her the motivation to keep reading. The article reflected some of her pedagogy, as well as giving her ideas to add to her practice. Elizabeth was not pleased with the article’s organization and structure. She would have liked the article to be “better laid out,” with more specific subtitles or other visual clues to help determine the four skills the authors highlighted throughout the text.

After reading the five pages, Carmen decided to finish the article. She felt that Springer et al. gave examples of teaching practices that were a part of her teaching practice. While reading this article, Carmen demonstrated the synthesize, analyze, and apply reading cycle. When she first saw the title (before reading the article), Carmen felt a bit concerned and asked herself, “How are we going to make each kid college-ready?” She felt reassured that she was using some of the suggestions and that she was “not dropping the ball,” which gave her more confidence in her pedagogy.

When asked about the Springer et al. article, Gosset was quite pleased with its content. She thought there were “things to learn from it and that there was also a lot of knowledge that I’ve been messing around with that was confirmed, which is really nice.” Gosset appreciated that Springer et al. summarized the importance of making students college-ready. In addition, she welcomed that it reinforces what she wants to practice in her classroom. Along with her Master’s courses, Gosset has been working with a math consultant, applying metacognitive development to her classes; she found the article supported this other work. Gosset was planning to keep the article for future reference.

During the post-think-aloud discussion I asked each participant what they thought about the article; their answers were enlightening. Carmen commented that it is essential to assist students to grow in their use of reading skills, and to communicate to them that just because they are a weaker reader now does not mean they will be the same type of reader in the future. This comment reminded me of Gosset’s growth as a reader. She had viewed herself as a weak reader throughout her life and even recognized herself in the not-college ready vignettes in the article. Gosset is a reader success story. Through hard work and perseverance, she has become an accomplished reader who recognizes her strengths and weaknesses. Her participation in this research at the same time as she was completing her History of Math course helped her immensely. During the final post-think-aloud discussion, Gosset told me that she would practice what she had done with me during the think alouds, and that it had helped with her immensely with the comprehension of the many articles she needed to read for the course.

Participants' Post-Think-Aloud, Reading-Specific, Nonvernacular Social Language Awareness

Once the participants completed all the think alouds, each partook in follow-up interviews. During these interviews, they discussed their metalinguistic awareness of the reading-specific nonvernacular social languages (Gee, 2014) they had used during the discipline-specific text readings. This section will include each participants' explanation of their post-think-aloud awareness of the literacy practices, including skills, strategies, and thinking processes. Appendix P contains a diagram showing all the literacy practices the participants used. There is a big difference between those lists and what they were able to verbalize during the follow-up interview.

Goodall recognized that she used different reading strategies while reading discipline-specific texts than she used when reading for pleasure—what she described as “fluff” reading. She explained that while reading a romantic comedy, for example, she would skim and scan pieces of the text that she did not remember or that had lost connection to the content, whereas, in a discipline-specific text, she had to make sure all of the ideas lined up and linked together. The light reading was usually for entertainment, and therefore was not critical to her teaching or discipline-specific learning. Successful discipline-specific reading requires a much closer read. One of the main differences that Goodall identified between light reading and science texts was the purpose for reading. Her purposes for reading discipline-specific texts included the desire to know the content well, the usefulness of the content for her classes, and the interest she had in the text content. Goodall said, “A different purpose will require different reading strategies—leisure reading compared to discipline-specific reading.” This coincides with Rosenblatt's aesthetic and efferent continuum of reading for specific purposes.

Goodall explained that even when she was prompted to think about her thinking and explain it, she found it difficult because much of her reading skill and strategy use had become routinized. Goodall explained that she used four strategies, regardless of the text: (a) using a dictionary to learn unknown vocabulary; (b) rereading; (c) having a conversation after reading the text to determine whether she had understood it correctly, and also to discuss the information to determine what others think about the subject; and (d) storing the information gleaned from the text, to use it later. When reading discipline-specific texts in particular, Goodall noted that using a pencil while reading is very helpful for her. She highlights, circles, and annotates, showing her inferences and making connections with what she learned about the text content. She explained, “I’m actually using the pencil throughout the reading, so it reminds me to pay attention to the stuff that hopefully has come before.”

Goodall was very cognizant of the text structure. The synopsis that she read before reading was essential to her understanding of the text. She remembered the synopsis so that “I can follow the whole direction or logical order of what’s being presented. In narration, I really didn’t pay attention to those kinds of things in the text.” She found reading narrative texts much easier to follow than science texts.

During Elizabeth’s post-interview, the SS participant explained that when reading any type of content, she uses her background knowledge:

When I read something that is discipline-specific, it is compatible and fits neatly into that baggage tucked away, and it’s compatible with the thoughts I already have; whereas, if I’m reading something that is not discipline-specific, and I lack that background story, then I have to delve into it a little bit more, and I am not able to anticipate what the next concept might be.

There is importance in the amount of background knowledge Elizabeth possessed in order to understand her reading. As well, she anticipated (predicted) what was going to come next, and was curious as to where it would fit with her background story:

I don't have that when I'm reading something that is not discipline-specific ... If I'm reading something that I have no prior knowledge [of], especially if I'm on the Internet and then it's like a strand [connected] to another strand, which leads to another strand ... [I] follow those links until the jigsaw puzzle all fits together.

Elizabeth also noted that she “created images in her head” and made sure the new information “fit in chronological order in my head.” Visualization is an important reading strategy for her.

When reading discipline-specific texts, Elizabeth used the information to complement what she already knew, to help with enrichment for her students. She used the title of the texts as clues as to “whether or not it is something I need to read.” The title also added to the expectation she might already have of the text. As well, Elizabeth noted that “sometimes [her] eyes dart across the page because sometimes disciplinary texts are set up a certain way [using] a certain organization.” She also was cognizant of text genre and was looking for agreement with her background knowledge. Elizabeth used various self-monitoring skills, such as knowing when she was not understanding. When that happens, she reread or looked up the information in another text. As she reads something new, she wants to ensure it fits into “that baggage in my mind and my expectations.”

During the post-interview, Carmen, the ELA teacher, identified a limited number of literacy practices, including reading skills and strategies, but demonstrated many more in her reading during her think alouds. When reading various types of texts, Carmen gave examples of metalinguistic awareness, such as her use of “I wonder” and questioning. She also made

connections and looked up information, and she used the same strategies in SS as she used in ELA. While reading a difficult discipline-specific text, Carmen would slow down and read it aloud, because hearing it helped her make more sense of the content.

During the post-interview, Gosset explained that with texts of all kinds, she summarizes, infers, uses previous knowledge, and paraphrases. She was quite explicit in stating that she paraphrases when reading history and other non-discipline texts as well as mathematical texts. She uses deep [close] reading when reading mathematical parts. She often uses the strategy of mumble reading:

[I] read out loud when there is something I don't understand or something that I really need to grasp the concept of. I also do that not just in the mathematics, but I just read yesterday, or last night, science and religion and the historiography of the Galileo affair and there was a lot of reading out loud there, because it's very philosophical and sometimes the philosophy stumps me, but I think I use quite a few things that run across different literacies or different texts.

While reading a discipline-specific text, it appeared Gossett often needed to hear it out loud (private speech). She explained, "I'll go back, and then when I have the 'aha' moment, I can finally continue." Gosset reads, then rereads quietly to herself, and then sometimes uses mumble reading. Writing down information helped her with comprehension. Gosset explained, "Sometimes I'll write down what I'm saying as well as sometimes my thoughts on the mathematics." She uses researching to clear up a lack of understanding. She repeated that she goes back, rereads, reads out loud, thinks out loud, and takes notes.

The participants gained a more complex conceptualization of disciplinary literacy throughout data collection. Their definitions went from general understanding to being aware of

the discipline-specific text differences that they wanted to add to their instruction. Interestingly, the growth I observed in their ability to communicate thinking during the think alouds was not demonstrated as much as I had expected during the post-think-aloud responses. Even though I had questioned the participants regarding the literacy practices they used during the think alouds, they did not think to express their use of all these skills and strategies during the post-think-aloud interviews. How do they acquire the metalinguistic awareness to be able to converse about it?

The Evolution of Disciplinary-Literacy Understanding

The participants went on a discipline-specific literacy journey as I collected my data. Their understanding of disciplinary literacy evolved. At the beginning of the research, Goodall defined disciplinary literacy as “you have the ability to decipher specific concepts or subjects and all the information that comes to you—text or otherwise.” She explained that she would not be strong in music literacy “I have a general idea, and I played in band for a long time when I was younger, but now, I have not practiced, and it’s kind of gone, and the same thing would apply for science or math.” A person is not “scared” of the specific words and can figure out meanings—get context clues from what they are reading. According to Goodall, each discipline has different texts that have a way of presenting content information. In the sciences, texts include genre such as, lab reports, videos, textbooks, maps, graphs. Genre such as scientific articles and lab reports use specific formats that are not like the formats used in textbooks, because the articles and lab reports do not always have pictures or other text features attached to them, which assist the reader in making or finding meaning. One statement Goodall used often is that “You can find science anywhere ... it is a part of your everyday stuff.”

During the follow-up interview, Goodall explained that she was able to be more intentional in the delivery of disciplinary literacy. When it came to texts, as a teacher, she was

more cognizant of each genre of science-specific texts and was very clear that she understood that these texts present the information differently than do ELA, math, or social texts:

If I'm a discipline literate person, that means that I'm comfortable in analyzing and wading into a [science] text of any kind ... If you're like me, I've spent most of my time in science, so I am comfortable with the "research part" of reading science articles ... Where[as] somebody in social studies is more used to the history and historical writing presented, which is more chronological ... they will be more comfortable with that.

In addition, Goodall was more aware of the importance of teaching her students how science genre are organized, including implemented text features. She was planning on being more deliberate by adding questions to her lessons, such as, "Do you understand how it's organized?" or "Do you understand how it is structured?"

Initially, Elizabeth defined disciplinary literacy as being able "to read something particular to that subject, to that program of studies, and understanding it and being able to then take what I'm reading and being able to make the connection with that field." She further explained her understanding of disciplinary literacy:

Let's say I'm reading about the French Revolution. I have to be able to make the connection to how—as I teach—am I going to be able to insert this into my lesson plan; how can I insert this into what we're currently studying?"

At the end of the research time, Elizabeth was able to give more details to her understanding of disciplinary literacy. According to Elizabeth, disciplinary literacy does not separate reading and writing. "You don't want to separate these two strands because they almost overlap so much it's hard to know the difference between the two—where one begins, where one ends." Elizabeth found it difficult to put into words her idea of discipline-specific literacy. She

stated, disciplinary literacy is “the ability to ... make out words so, they can make out sentences, so they can make those thoughts. But in your own discipline it’s subject-specific.” It is understanding the discipline-specific information. Elizabeth was the only participant to refer to the syntactic and phonemic awareness needed to read. She mentioned being “able to make out words, so they can make out sentences, so they can make those thoughts.” Elizabeth also stated that it was “understanding the textbook and being able to read it and to being able to manipulate the information in it with the students and its disciplinary literacy.” She explained that it is subject-specific in a specific discipline in a specific course. Examples she provided were a textbook for students and resource material for the teacher that equipped them to teach information that would enhance and complement the textbook.

Carmen’s preliminary understanding of disciplinary literacy meant using strategies that she would have learned in an English class, which included figurative language, using foreshadowing, or using context clues to understand unknown vocabulary. She thought that the strategies she learned in English could be transferred to other discipline-specific texts:

There are some certain things I don’t know about... in terms of science. I might not know the exact science terms, but I should have some stuff I learned in English class that can help me figure it out, like maybe I learn something like “this prefix is Greek always means life,” so logically I should be able to figure this out.

Carmen thought each discipline uses strategies that go with a specific subject or specific class. According to Carmen, “I’m sure there are ways that they talk about it in math that I have no idea, but they are using literacy techniques there.”

Latterly, Carmen found it interesting that throughout the whole data collection experience, she “vacillated on if there is such a thing as disciplinary literacy, or is it just

literacy?” She would waver from one to the other. Carmen explained that it could have been partly her own experience because she views herself as a good reader and a smart person, so she felt she could understand most texts and most disciplines or “at least get the gist of them.”

Carmen did clarify that if she were stronger in one discipline, she would get more out of that discipline-specific text. She was not sure if she would get more out of a math text than a math teacher would, because she (Carmen) does not know what to look for. Carmen did make clear that in order to be a discipline specialist, a person needs to invest time to learn about the discipline. Being naturally smart and being a naturally good reader is not enough at a certain point. Natural talent takes a person only so far. Finally, she defined disciplinary literacy as:

having strength in a specific or in multiple disciplines that ease your way or help to ease your way into the text. So, if a person wants to be an expert in the field, being naturally smart is not enough. You need to have that discipline in disciplinary literacy in order to be able to do it.

For Gosset to formulate her initial disciplinary-literacy definition, she looked up a definition and then articulated her own:

The discipline is the content, so that math would be my discipline, and English would be somebody else’s discipline, and physics would be somebody else’s discipline. And so, reading in those particular classes or in those particular structures ... the discipline is the content.

Gosset was working on a History of Math course as she was participating in this research. When thinking about this course and its readings, Gosset had to change how she wrote about the historical content versus when she wrote about number system work. She was unquestionably

aware of two different disciplines —history and mathematics—and it so happened that she was interacting with them at the same time and experiencing the juxtaposition.

During the follow-up interview, Gosset explained that through partaking in this research, “I think that I now understand disciplinary literacy to mean how you would read individual texts. Science literacy, math literacy, history literacy, philosophy literacy, whatever the discipline means, and I think that there are a lot of similarities.” Her understanding was that the same tools—self-monitoring, analyzing, sequencing, making connections, visualization, summarizing, predicting, inferring, synthesizing, evaluating, finding word meaning in context—can be used in all of them. Gosset, however, did not think everybody could do all of them:

I really, really struggle with the philosophy paper. You know it’s really hard, and you think it shouldn’t be [for someone] who is mathematically inclined, but I had to read that thing five times. I know I’m going to have to read quite a few times, but once I see it, then I can make the philosophical arguments very factual, and then it’s the mathematical part of it that I think I’ll be good at.

Gosset saw the importance of background knowledge in a person’s ability to understand discipline-specific texts. She was able to understand the philosophy paper because she had taken an earlier philosophy course. As well, she believed that by taking part in this research, she was able to slow down and take more time. If she did not understand, “that was okay.” Gosset had to reread or realize she could not use that information because she did not feel comfortable writing about something she did not understand. Gosset learned when it was okay to skim and when she needed to read more closely. She had never done that before and had gained the confidence to recognize what information was useful and what information could be omitted.

The readers' background knowledge or personal associations (Rosenblatt, 2013) was imperative to their understandings of the text and was necessary for the participants to use reading skills, strategies, and thinking processes. They used similar literacy practices while reading various texts but because of their varied discipline-specific background knowledge the strategies were applied a bit differently for each discipline.

Participants' Reflections About Their Pedagogy

During the course of this research, each teacher became more cognizant of her metalinguistic awareness. Each teacher also began to want to consciously and purposefully add disciplinary literacy to their instruction. They recognized the need to include how they think, as a discipline specialist, in their teaching. Each of them—in different ways—felt a sort of conviction to improve instruction to include terms and understandings of texts, thinking processes, and reading strategies such as inferring, paraphrasing, and summarizing, which they had not used as purposefully within discipline-specific lessons before taking part in this research. They all expressed concern about how to do this effectively without having to redo all their lessons.

Interestingly, both Carmen and Gosset were relieved to find that they knew what they were doing as they read. It seemed that these two teachers had the perception, but it was not until I questioned them regarding the terms to describe their reading skills and strategy uses, that they could explain what they were doing. My concern is that because they may not have the supports—time, opportunity, and money—to make the necessary changes in practice, they will continue teaching with a bit of frustration, knowing what they should be doing but not having the support or confidence to change.

Goodall voiced a strong need to change some of her teaching practice in order to better teach discipline-specific thinking. During the follow-up interview, when Goodall was explaining

the reading skills, strategies, and thinking processes she used when reading discipline-specific texts, she pondered that during the first parent-teacher interviews of the year:

[I would spend time] talking to kids about how they study for science, and if all they do is reread the notes, they're never going to get a better grade because they did nothing to actually move their bodies. So, are you creating a story web because maybe you are a language person? Have you actually highlighted all the words that are important? Have you written yourself notes? I did that for parent-teacher interviews, but I never did it once in the class. Huh!

This was like a eureka moment for Goodall.

Additionally, during the follow-up interview, Goodall used the word “indictment” five times to cast aspersions on what she thought was a deficit in her teaching. In one of the instances, she explained this shortfall:

I would explain how writers of texts write in a French language arts (FLA) class, but I haven't done that for a science class. And is that an ... indictment. But is that a nudge or a push to diversify the kinds of texts that kids see in a science class? That's interesting. Hmmm. Because for sure, you spend time on a variety of types of text in an ELA or FLA class, but I don't know if we do that in science.

Confirming the idea of content-literacy dualism (Brozo et al., 2013), like many discipline specialists, Goodall “relied on my language teachers to do that [to teach students genre features and organization], which is actually not a good default position to be in because it is a different kind of text, and if they don't understand ...” Goodall went on to say that she felt as though she was failing her students because “some kids would truly benefit from this, so how do you absorb and spend time?”

Elizabeth showed her awareness of and her desire to add more disciplinary-literacy thinking and skills into her teaching; this reveals a shift in her desire to change her pedagogy:

I guess I'm aware of it [disciplinary literacy]. The other day when I was reading to my students, I said, "No, stop for a minute and think of what the image of this is." That was interesting to me because I would've never asked my students before to think of an image. It was significant to Elizabeth that, when teaching, she needed to vocalize as she was reading and to be mindful of some of the tools and strategies she did use, such as visualization and problem-solving. She saw the importance of teaching how to use text features, such as tables, graphs, and pictures, that relate to the text students are reading:

Now, even as I'm reading, I'm even making the connection [for the students]. Okay, now, so we are going to read about this, so look at the pictures beside and see how it connects with what we just read.

She had the desire and the tools to bring her students to the understanding of the connection between the pictures and text in the reading. Elizabeth stated, "I'm conscious of the connections students have to make with the written material, and not taking that for granted." She had always read to her students and may have assumed that they understood where they should or how they should be reading a textbook.

Throughout this research, Carmen's understanding of her reading practices, as well as her teaching practices, evolved. As a reader, she was encouraged to know that she was already employing many reading strategies and skills but did not recognize them. Carmen did not have labels to communicate all the reading skills, strategies, and thinking processes she used:

For the think alouds, when you were asking me for specific things, I was more thoughtful about what I was doing and for what I was looking. It's almost like the myth of ubiquity,

and it's a theory that when you become aware of something, you suddenly start seeing it everywhere or you become more aware of it. You told me that I was doing the things and then suddenly I was noticing that I was doing them all the time.

Of all the participants, Gosset's view of herself as a reader appeared to change the most, which seemed to empower her desire to shift her teaching practice. Like the other participants, she was not able to apply specific labels to all the strategies and thinking processes she used. Gosset stated that the way she reads has changed because "she went on this weird little journey where we were magically hooked up at the same time." It so happened that the last paper she had to read for her course was a difficult, 20-page philosophy paper. Gosset explained it took her an hour to go through the paper the first time, as well as the second time. Through her involvement in my study she had gained the perseverance, skills, and strategies to read the paper. Gosset explained, "if you gave this to me last year, I would've said goodbye."

Gosset's self-monitoring came to the forefront as she was reading her articles for both the think alouds and her math course readings. She explained that with every new article, she needed to be aware to slow down while she read. Gosset would question herself as to why she annotated, and what annotating was doing for her comprehension. As well, she wanted to become more conscious of the reading strategies and thinking processes she used, such as paraphrasing. After I had pointed out a few times that she was using various strategies and thinking processes, Gosset explained she was starting to recognize her metalinguistic awareness when she read on her own. After being a research participant in this study, Gosset expounded that she understands the text in much greater detail because we have been paying attention to how she read. She stated, "it has been very, very helpful for [me]. I was lucky."

Gosset had been interested in helping students understand their discipline-specific texts, and she had been employing some reading strategies and thinking processes within her classes. She explained that she had been scaffolding and modelling how to read the texts. Gosset also had students conduct a paired reading activity with mathematics. She would show her students how to use a strategy or thinking process, have them do it together, and then she would slowly back away. But she was concerned that she did not use a specific text. Gosset wanted to become more adept at teaching students to access the subject materials more independently. She had a strong desire to spend less time talking to her classes and have students do more thinking on their own:

They need to have more time to think for themselves, so ... how are they supposed to figure out how they're supposed to read disciplinary-specific texts if I'm reading it for them? So, I think that's where a big change is, for me.

Gosset realized through the research process that her better-developed understanding of discipline-specific reading was going to be an asset in her math and statistics classes. Student reading skills need to be honed, because the study of statistics requires students to read “massive texts” and be able to pull out the necessary information. She wanted them to understand how each genre works. Her students would then be better able to understand how they work, and better able to ascertain the information they need or are seeking. They would be able to read the texts more effectively and efficiently. Gosset explained when teaching Math 10-C linear functions, she was going to give her students:

what the big picture is, to increase the difficulty of the question and remove myself from the learning, and so I would really like to be thoughtful about teaching less and letting them do a little bit more, but at the same time going back to what the purpose of all of this is, and I really want to teach the purpose.

Goodall, Elizabeth, Carmen, and Gosset all felt that they had gleaned valuable discipline-specific reading experience and understanding, and all had a strong desire to add more discipline-specific literacy to their next year's classes.

Chapter Summary

Throughout this chapter, I let the voices of the research participants demonstrate their metalinguistic awareness of the use of various literacy practice nonvernacular social languages (Gee, 2014), including the reading strategies and skills and thinking processes they employed during text engagement. They demonstrated the evolution of their disciplinary-literacy understanding, as well as their desire to revise their pedagogy by implementing more discipline-specific literacy and thinking. In the next chapter, I explore study findings based on my interpretations of the teachers' engagement with texts.

Chapter Five: Study Findings

The reader brings to the work personality traits, memories of past events, present needs and preoccupations, a particular mood of the moment and a particular physical condition. These and many other elements in a never-to-be-duplicated combination determine his [her] response to the text. (Rosenblatt, 1938, pp. 30–31)

Chapter Overview

Ely, Vinz, Downing, and Anzul (1997) maintain that “interpretations arise when patterns, themes, and issues are discerned in the data and when these findings are seen in relation to one another and against larger theoretical perspectives – our own newly emergent views or those found in ‘the literature’” (p. 160). In this chapter, I communicate the themes that became evident through the interpretation of information gathered. Bogdan and Beklin (2007) explain that “interpretation involves explaining and framing ideas in relation to theory, other scholarship, and action, as well as showing why your findings are important and making them understandable” (p. 159).

Various theorists (Street, 2006; Vygotsky, 1978; Rosenblatt, 2013; Gee, 2002) recognize that literacy and its various aspects are sociocultural interactions. Reading is an example of what Wertsch (1991a) calls human mental functioning which is “inherently situated in social interactional, cultural, institutional, and historical contexts” (p. 86). While people are reading, transactions take place that involve the reader and their experience, the text itself, and the author (Rosenblatt, 2013). Moje (2007) emphasizes that disciplinary literacy is produced, reproduced, and communicated in each discipline daily, within a sociocultural context.

Analysis of emerging themes was directed by the conceptual frameworks of content-based literacy, discipline-specific literacy, transactional theory (Rosenblatt, 2013), nonvernacular social languages (Gee, 2014), and automaticity of thinking (Godde et al, 2020; Kuhn et al., 2010;

Bodrova & Leong, 2007; Gal'perin, 1969; Samuels et al., 2006). In the previous chapter it was demonstrated how secondary discipline specialists engage with discipline-specific texts, and what they had to say about each reading experience. Through these insights, patterns emerged, and from these patterns, I identified themes. Several significant topics materialized that pertain to the participants' engagements with discipline-specific texts. My study participants used literacy practice nonvernacular social languages (Gee, 2014), including specific reading skills, strategies, and thinking processes, to comprehend texts. The participants' dependency on their background knowledge or personal associations was imperative to their understanding of the texts. My data showed the blurring of aesthetic and efferent stances and the importance of the transaction that takes place between the reader and the text (Rosenblatt, 2013). The automaticity (Godde et al., 2020; Kuhn et al., 2010; Bodrova & Leong, 2007; Gal'perin, 1969; Samuels et al., 2006) of the skills, strategies, and thinking processes used while the participants read was a very interesting finding. The last topic revealed through my analysis was the particular ways in which the participants read discipline-specific texts (Lent, 2016; Shanahan & Shanahan, 2008, 2012; Shepherd & van de Sande, 2014).

For this chapter, I have arranged the various topics into three interrelated themes that revealed how the participants engaged with discipline-specific texts: (a) literacy practices—reading skills, strategies, and thinking processes; (b) cognizance of literacy practice use; and (c) reading as discipline specialists.

Literacy Practices

In this section, I demonstrate the literacy practices, including reading skills, strategies, and thinking processes used by the participants. By using think aloud, the participants revealed their metalinguistic awareness of their practice. Select literacy practices that the participants

utilized, described in this section, include using private speech, having purposes for reading, having stances when reading, transacting with authors, and employing specific reading skills, strategies, and thinking processes.

Private Speech

Like other readers, some participants required private speech as a reading strategy. Bodrova and Leong (2007) explain that private speech depicts “self-directed speech that is audible but not intended for others” (p. 66). Private speech’s function is self-regulatory. Private speech is used by all ages of readers to understand text. Both Carmen and Gosset were very clear that they needed to speak as they read by reading out loud, or by talking about their metalinguistic awareness. They knew that reading and speaking out loud, or using private speech (Aulear Owodally, 2021) or mumble reading (Kragler, 1995; Gilliam et al. 2011), were useful reading practices that helped comprehension. Goodall and Elizabeth used this practice but did not vocalize its importance to reading comprehension. My research confirms the perspectives of Vygotsky (1987), Britton (1982, 1983), John-Steiner (1992), Bodrova and Leong (2007), and Wegerif (2011) on the importance of speaking; specifically, private speech is an essential comprehension tool for some readers. These scholars point out that speaking is the foundation of literacy learning, including reading. Britton (1983) states, “Reading and writing float on a sea of talk” (p. 11). Bodrova and Leong (2007) point out that adults use private speech “when faced with a difficult multistep task” (p. 68). Because of the importance of private speech in reading comprehension, secondary teachers need to remember that their students may require the space to verbalize their thinking as they read. Private speech was used by all of my participants; the discipline was not a determining factor. Reading a difficult text can be challenging work.

Advanced readers including most teachers, according to Prior and Welling (2001), tend to read silently rather than orally. Adults tend to consider reading a private activity in which they demonstrate language that has been moved from a social world into a private world—private speech (Vygotsky, 2012). Private speech, according to Auleear Owodally (2021), is “speech-for-the self, dialogue with oneself, a type of intrapersonal speech that is externalized or vocalized or written down” (p. 18). It is often used as a self-monitoring strategy (Lantolf et al., 2015). When reading a difficult text, child or adult readers may also use what Kragler (1995) and Gilliam et al. (2011) call mumble reading (reading out loud for self). Prior and Welling (2001) explain that the use of mumble reading is a means of self-monitoring. Trainin et al. (2015) point out that readers who use oral language can have higher comprehension.

Purposes for Reading

Goodman (1996) emphasizes the need for readers to have purposes as they read. Each participant chose purposes for reading beyond the purpose of reading for this research. They saw the value of reading purposes. This value corresponds with the views of scholars such as Goodman (1996), Tovani (2000), Ogle et al. (2016), and Harvey and Goudvis (2017). Having a clear purpose for reading helped participants to engage with the text and keep focused. The two primary purposes used by participants were to be entertained and to be informed for personal understanding, as well as what Shulman (1986) refers to as teacher content knowledge. Sometimes the purposes that the participants chose lined up with the authors’ purposes, and other times they did not. Some of the texts were meant to inform, but the participants found the texts entertaining as well as informative. The importance of having reading purposes is not restricted to adult readers. As adolescents are reading various texts, teachers need to instill in students the

importance of having purposes or reasons for reading texts. Having purposes for reading helps establish reading focus and interest; this assists readers of all ages to read various levels of texts.

Reading Stances and Author Interactions

The importance of reading purposes aligns with aspects of Rosenblatt's (2013) transactional theory, specifically reader stances—aesthetic and efferent. Like most readers, the participants in this research seemed to blur the two stances as they read during the think alouds. The emotional connection (aesthetic stance) for the content being read for information (efferent stance) seemed to be just as important as the information gathering. Through the enthusiasm and excitement in their voices, as well as through word and phrase choice, each participant demonstrated their passion (aesthetic stance) for their disciplines and the texts they chose. There are several examples of each participant's emotional connection to the reading. Goodall found humour while reading *Buzzkill: Will America's bees survive?* (Volk, 2017). Elizabeth was fascinated while reading *The great war* (Merriman, 2010) and *The west between the wars* (Ralph & Lerner, 1991). Carmen loved learning new words while reading *The witches of New York* (McKay, 2016). She was also found humour while reading *The enchantress of Florence* (Rushdie, 2008). Gosset appeared to enjoy working through the various proofs in the texts she chose. Gosset also demonstrated her admiration of the statistician Gosset while reading *The Guinness brewer who revolutionized statistics* (Kopf, 2015). Each participant appeared to enjoy their information gathering; it was not a chore. Their experience while reading these texts went beyond knowledge and fact gathering. Rosenblatt (1991) claimed that most reading is primarily, rather than exclusively, one or the other. She contended that while reading, the reader's stance can shift along the efferent/aesthetic continuum. At times, my participants appeared to be reading from an aesthetic and efferent stance simultaneously, not simply moving along the continuum.

The blurring of the efferent and aesthetic stances is significant in two ways. The first is that the purposes of reading seem to be connected to the stance the reader takes. For example, if the purpose is to entertain, then the stance is clearly connected to the aesthetic stance on the continuum. If the reading purpose is to inform, the stance is more of an efferent stance. With that said, the participants demonstrated that in their quest for information, they enjoyed the information gathering. They enjoyed it so much that they were reading from an aesthetic as well as an efferent stance. I prefer my phrase, *blurring of stances*, compared to being somewhere on the aesthetic and efferent stance continuum (Rosenblatt, 2013) or stance within stance (Paulson & Armstrong, 2009), because the participants were often positioned using the two stances simultaneously, each stance having the same significance in comprehension. When reading discipline-specific texts, it appears to be important that a reader makes an aesthetic connection to the text as they are trying to gather information. Each of my participants was passionate about their discipline-specific reading; even when the reading was more difficult, they were able to engage the necessary reading literacy practices and persevere with the assistance of their aesthetic stance.

Unfortunately, many discipline-specific texts tend to be so content-heavy that they add little enjoyment to the reading. The participants in this research showed that as they were reading for textual information, they were positioned using the aesthetic and the efferent stance simultaneously. According to Rosenblatt (1978, 1991), as a fiction text is read it is expected that the reader would read it using the aesthetic stance, so it was to be expected that Carmen would enjoy the fiction texts she read. However, on several occasions Goodall, Elizabeth, and Gosset read aesthetically as they were efferently gathering facts and knowledge while reading their non-fiction texts. The strong aesthetic stances taken by Goodall, Elizabeth, and Gosset seem to

challenge Rosenblatt's (1978) idea that readers of non-fiction usually position themselves using an efferent stance. The love of the topic is one factor that gave participants the motivation to continue their reading.

Having a love for the subject matter makes understanding discipline-specific texts easier. The fluidity along the efferent and aesthetic stance continuum often blurred the stances that signified the passion and love each participant possessed for their disciplines. The passion for the subject matter gives the readers intrinsic motivation to continue reading even difficult texts. The participants' experiences with their reading engagement provide evidence that if readers do not have an aesthetic experience when they read, they are more likely to have problems understanding the text (Rosenblatt, 1978, 2013). Each of my participants demonstrated enthusiasm and delight in learning more about their discipline. Even when they found the texts difficult, their love of the content and of learning gave them the motivation to continue reading. Additionally, they were motivated to retrieve information from their texts; they were taking the aesthetic and efferent stance at the same time. Rosenblatt (1991) maintained that most reading is predominantly, rather than exclusively, either aesthetic or efferent; when reading, the reader's stance can shift along the efferent/aesthetic continuum. Stance can move as a text is read. I concur with Galda and Liang (2003), who state that "most readings are a blend of the two stances, with the "pure" reading from either stance being quite rare. Passion for a specific discipline has important implications for students, teachers, and administrators; I discuss this further in the next chapter.

Another aspect of Rosenblatt's (2013) transactional theory that was revealed through this study was the transaction between the participant (reader), the text, and the author. Reading is a sociocultural event during which the reader understands by combining their own experience and

ability with the text itself and the content the author intends to communicate. The reader is actively involved, constructing texts rather than passively consuming them. One aspect of this transaction was uncovered via the participants' comments and questions about the authors. By engaging with the authors, participants demonstrated the importance of the authors' abilities to communicate with the reader. This research confirms the existence of the transaction between the reader, the text, and the author. My participants actively engaged with the texts, combining their experience and reading ability with the text and with ideas that the authors provided. Building secondary teachers' mindfulness of the importance of this transaction in reading engagement may improve their metalinguistic awareness. This greater awareness may improve the pedagogical practice in discipline-specific classrooms, with the goal that readers will comprehend texts more effectively. If teachers are aware of the transaction that takes place as they read, they may have better tools to teach disciplinary literacy more effectively. This transaction that takes place requires readers to use various literacy practices such as reading skills, strategies, and thinking processes.

For the participants in the research, to have used these literacy practices effectively, they needed to have had firm background knowledge of the content of the texts, as well as of reading

Background Knowledge Dependency

Each research participant used a variety of literacy practices to understand discipline-specific texts. The most noteworthy was the employment of background knowledge—personal associations (Rosenblatt, 2013)—combined with the information given in the text. Without strong background knowledge or personal associations, participants would not have been able to understand the texts that correspond with many researchers (Neuman et al., 2014; Moje et al., 2010; McVee et al., 2013; Marzano, 2004; Langer, 1984). When the participants made

connections to the text via text, world, self, or within the text, they were taking part in a transaction between the text they were reading, the author, and the readers themselves. The reading strategies and skills and thinking processes they employed were related to their backgrounds and understanding. All the skills and strategies implemented required that the participants use their personal associations or background knowledge.

The need for robust personal associations was emphasized repeatedly as participants read their discipline-specific texts. Many, if not most, of the reading skills and strategies used required background knowledge. The participants' abilities to understand difficult vocabulary, infer, analyze and synthesize information, paraphrase or summarize new information, recognize genre features and organization, and visualize are all directly connected to past experiences with text, self, and/or world. As demonstrated in Chapter Four, connections to the text were consistent throughout the participants' think alouds. If they had not had strong personal associations, the participants would not have absorbed as much content. This evidence solidifies the importance of teachers having strong discipline-specific teacher content knowledge, which impacts student learning.

What happened when the participants read articles outside their background knowledge? The participants used reading competency to understand the text, which concurs with Moje et al.'s (2010) views. For example, when reading the chemistry text (Lin et al., 2017), Goodall used her reading prowess to understand the text. Among other reading strategies and thinking processes, she reread, obtained definitions of unknown words, and asked questions so she could understand. More background knowledge in the subject area would have made the reading more accessible, but with perseverance, Goodall prevailed. As an adult with positive reading experiences and ability, Goodall also had the motivation to continue reading. All participants

possessed background knowledge regarding the literacy practices and content needed to understand the texts.

Cognizance of Literacy Practice Use

The participants in the research successfully read discipline-specific texts but were unaware of the many literacy practices they used. In this section, I discuss two important aspects of their cognizance of literacy practices. The first is the participants' literacy practice Discourse (Gee, 2013) to explain their thinking. The second is the automaticity (Godde et al, 2020; Kuhn et al., 2010; Bodrova & Leong, 2007; Gal'perin, 1969; Samuels et al., 2006) of thinking as they read.

Literacy Practice Discourse

To demonstrate thinking as they read, the participants required language to explain their use of literacy practices and to communicate their metalinguistic awareness. This situation-specific language (Gee, 2004) is what Gee (2013) refers to as Discourses, where people have been socialized to use specific language. According to Gee (2013), "A Discourse integrates ways of talking, listening, writing, reading, acting, interacting, believing, valuing, and feeling (and using various objects, symbols, images, tools, and technologies) in the service of enacting meaningful socially situated identities and activities" (p. 143). More specifically, the disciplines of science, SS, ELA, and mathematics require a particular Discourse to enable a person to understand the content of each discipline's texts. Gee (2014) described the specialist language that discipline teachers use as *nonvernacular social language* (p. 23). The participants explained their metalinguistic awareness using the Discourse they employ and understand. The non-vernacular social language they used was not necessarily the Discourse I expected them to use to describe their thinking.

Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014) give discipline-specific reading characteristics that discipline specialists would find helpful to add to their reading, speaking, and writing language. Shepherd and van de Sande (2014) describe math specific literacy practices. I refer to this discipline-specific language as “discipline-specific Discourses” or nonvernacular social language. The participants were able to understand the texts using many of the reading characteristics outlined by Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014), but in enacting these characteristics, they did not always use literacy practice nonvernacular social language to explain their metacognition. The ability to explain reading engagement thinking using nonvernacular social languages used in literacy practices would assist them in their teaching.

When explaining reading, a particular Discourse or nonvernacular social language is needed to label and explain the literacy practices that take place. This literacy practice Discourse could include the use of thinking processes such as evaluating, skipping, skimming, synthesizing, self-monitoring, paraphrasing, and analyzing. It could also include the discipline-specific language of Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014), to which I refer as “discipline-specific Discourse.” As the participants engaged with texts, they were able to understand them; even though they understood and verbalized what they were doing, they did not communicate the nonvernacular social language (Gee, 2014) I expected with which to label all the specific literacy practices. Therefore, in the analysis of the data, I applied reading skill and strategy and thinking process Discourse to communicate the literacy practices used. After listening to a think aloud or two, I became curious about whether the participants used literacy practices they had not thought to reveal. Some important literacy practices are visualization and being aware of genre organization, but the participants did not talk

about these reading skills or strategies. Once I questioned whether or not they used these literacy practices, they became aware of them, referring later to the use of visualization and text organization and structure. By increasing teacher metalinguistic awareness—making implicit thinking, explicit—we would be tapping into a valuable pedagogical resource.

Charter (2003) cautions researchers when using think aloud as a research tool because think aloud, as it turns internal discourse into external discourse, cannot reveal deeper thinking in its complete complexity. It is difficult for a person to reveal all their thoughts as or while they complete a task. Charters (2003) makes the point that people who participate in think alouds need to streamline deep-thinking processes into words that correspond “before anyone, even the thinkers themselves, can really know them” (p. 70). My participants needed to develop their think-aloud ability. Their capacity to communicate thinking would have been enhanced if they had known the nonvernacular social language labels for the reading skills, strategies, and thinking processes they employed. In order to have literacy practice Discourse available to secondary discipline specialists’ thinking, it would be helpful to have the metalinguistic awareness associated with reading reflected back at them, so they would be cognizant of all the things they are doing as they read.

Automaticity of Metalinguistic Awareness

One of the reasons many secondary discipline specialists need their reading reflected back to them is because of their limited metalinguistic awareness. The fact that participants were often unaware of their practice to label their reading process corresponds to what Gal’perin (1969) and other scholars (Godde et al., 2020; Roembke et al., 2021; Bodrova & Leong, 2007; Young & Rawson, 2018; Rawson, 2010; Samuels et al., 2006) term “automaticity.” Bodrova and Leong (2007) explain that ideas, concepts, strategies, and theories become so much a part of a

person's verbal thinking that their metacognition becomes automatized. Ironically, the automaticity that is required and encouraged for someone to become a fluent reader (Godde et al., 2020; Roembke et al., 2021; Samuels et al., 2006; Kuhn and Stahl, 2013) can be a hindrance to teachers' abilities to voice the literacy practices used to comprehend texts. The reading strategies and thinking processes that the participants had learned earlier had moved from being a strategy to being a skill, something innate, and had become automatic. As Andrews (1997) discovered, the ability of teachers to explain their metalinguistic awareness is difficult to acquire, and often what they think is not completely verbalized. There is a challenge making the unconscious, conscious (Cleeremans et al. 2020).

Metacognition or thinking becomes folded (Vygotsky, 1987) when a person thinks of many ideas simultaneously; a person may not be aware of all they are thinking at one time. The automatized thinking made it very difficult for the participants to verbalize thinking using a specific nonvernacular social language (Gee, 2014). The participants were able to explain what they did as they read but were not able to apply the specific label to what they were doing. For example, they did not use the labels I had used with them, such as "evaluating," "synthesizing," "applying," or "self-monitoring." Sometimes I would label the literacy practices right after the think aloud or notice the use of them as I transcribed. To be able to communicate thinking to students, it would be helpful for the participants to label their own thinking processes as they read.

In some cases, after transcribing a think aloud I would recognize literacy practices, including reading skills and strategies, as well as thinking processes that the participants had used but had not labelled as such. For example, they may have voiced the act of synthesizing but did not say they were synthesizing. Once I mentioned the strategy for the participants, during a

post-think-aloud debriefing, they became more cognizant that these were skills, strategies, and thinking processes that they did actually use. They then had the vocabulary (nonvernacular social language) to express such use, and they would sometimes refer to them during subsequent think alouds. By giving them the Discourse, I was meeting a need in ZPTD (Warford, 2011). Warford (2011) emphasizes that teachers benefit when being provided the opportunity to create their own frame of reference and professional action in a situation. The participants as teacher adult learners brought their background experience and ability to the readings (Hui et al., 2020; Jafar et al., 2021; Tharp & Gallimore; 1988). I honoured their knowledge but filled in some of their vocabulary gaps with the labels. Assisting a learner in their zone of proximal development (Vygotsky, 1978) is crucial no matter what the age, or whether one is a secondary student or a teacher. Like Cheung (2009), I endeavoured to give hints or reinforcement to participant thinking (p. 99). The degree of reinforcement varied with the teachers, depending upon their awareness to communicate nonvernacular social language.

My study participants were already moved toward consciousness by the simple fact that they were aware of the research questions I was studying and chose to be a part of this study. Cleeremans et al. (2020) also state that “conscious experience is not only shaped by learning, but that its very occurrence depends on it” (p. 115). The participants used a strategy without conscious awareness, including the experience of engaging in both think aloud and other moments of learning. For example, through the invitation to pause and reflect upon their thinking, they were required to move their awareness from unconscious to conscious to be able to articulate what they were doing when reading.

As noted in the previous chapter, the growth I observed in the participants’ abilities to communicate thinking using the appropriate Discourse or nonvernacular social language (Gee,

2014) during the think alouds was not consistently demonstrated in the post-think-aloud interview responses. Even though I had questioned the participants regarding the literacy practice Discourses they used during think alouds, they did not transfer all these literacy practices during the post-think-aloud interviews. For example, during the first few think alouds, the participants did not mention that they visualized as they read, so during a post-think-aloud debriefing, I asked each of them whether they had used visualization while reading, and each of them stated they had. By creating and asking good questions, I was able to gain richer insight into how the participants read. During the post-interviews, when asked what reading strategies they used while reading, only Elizabeth voiced that she “creates images in her head.” Goodall did comment that her reading strategy use was “innate,” which concurs with the automaticity of literacy practices I observed. Similar to the study by Shanahan et al. (2011), my discussions with participants, along with their responses and perceptions, helped them verbalize their reading engagement. This heightened articulation assisted me to determine the implications of the reading behaviours that were observed or not articulated.

It is vital that teachers use reading comprehension strategy awareness and Discourse as they model and teach the reading of discipline-specific texts. If secondary teachers could engage more metalinguistic awareness while reading discipline-specific texts, they would be using an otherwise unused resource to teach discipline-specific literacy practices to students. Automaticity is an important factor required for reading. However, for teachers to explain what they do as they read, the automaticity of their own reading literacy practices can make the explanation of disciplinary-literacy engagement difficult. An instructor’s ability to think aloud using the appropriate reading Discourse gives students the tools to understand and communicate their (the students’) thinking. In the next chapter, I explore how to assist teachers in their literacy practice

awareness and their ability to communicate the practices used to understand discipline-specific texts.

Reading as Discipline Specialists

For the purposes of this research, the teachers were considered to be discipline specialists because they had been secondary teachers instructing in their Bachelor of Education major or minor—ELA, math, SS, or science—for at least 10 years. They were readers of professional texts that informed their understanding of their subject areas. These teachers were also readers who were cognizant of and able to talk about how they thought as or while they read discipline-specific texts. With their education and teaching experience each participant could be considered a disciplinary expert in teaching and its Discourses or nonvernacular social language (Gee, 2014). They are familiar with many of the Discourses needed to teach disciplines, but seem to require more pedagogical language to describe their metalinguistic awareness. Even without this Discourse, they each successfully engaged with the texts read during the think alouds. As Gee (2013) maintains, language is situated within a specific context. Each participant had language that was situated (Gee, 2004) within each discipline that was necessary to understand discipline-specific texts. As Shanahan and Shanahan (2012) explain, disciplines require using a particular language:

Disciplines differ extensively in the fundamental purposes, specialized genres, symbolic artifacts, conditions of communication, evaluation standards of quality and precision, and use of language. Regarding language use, different purposes presuppose differences in how individuals in the disciplines structure their discourses, invent and appropriate vocabulary, and make grammatical choices. (p. 9)

To understand and use disciplinary language reflects a sociocultural perspective because each discipline has its own culture, genres, learning tools, communication styles, assessment standards, and nonvernacular social language.

Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014) have categorized some of the literacy practices necessary to engage with the texts situated within science, SS, ELA, and math classrooms. Appendix A contains a table of Lent's (2016) Shanahan and Shanahan's (2008, 2012), and Shepherd and van de Sande's (2014) practices. Lent's characteristics were created for discipline-specific teachers. Even though Shanahan and Shanahan's (2008, 2012) and Shepherd and van de Sande's (2014) characteristics come from research that targeted discipline-specific grad students and professors, they are applicable for my participants who have majors in disciplines and have teaching experience of these majors. The participants have the background knowledge and experience to employ the Shanahan and Shanahan (2008, 2012) and Shepherd and van de Sande (2014) characteristics. They may have had some advantage in reading the texts because of their teacher skill set and pedagogical understandings of learning.

In my investigation, I wanted to see whether each participants' text engagement corresponded with the compilations of Lent (2016), Shanahan and Shanahan (2012), and Shepherd and van de Sande (2014) as they described the literacy practices employed by discipline-specialists to understand discipline-specific texts. Each participant demonstrated aspects of the categories of literacy practices mentioned above.

My study findings concur with those of Di Domenico et al. (2018) and Faggella-Luby et al. (2012), that readers of discipline-specific texts require both content literacy strategies and disciplinary-literacy strategies. In order for discipline specialists to engage discipline-specific

literacy practices they need to use content literacy strategies. This overlapping of content-based literacy and disciplinary-literacy strategies blurs the distinctions between intermediate—content-based—and disciplinary literacy in the increasing specialization of literacy development (Shanahan & Shanahan, 2008; Faggella-Luby et al., 2012; Paul, 2018; Tang, 2016). A reader’s ability to effectively use content-based literacy will assist their ability to successfully employ the specific practices that specialists use to read and write disciplinary texts (McCarty & Degener, 2018).

The following are examples from each discipline where content-based literacy is required to employ disciplinary literacy. For readers of a science text to “chart, illustrate, and graph data and conclusions” (Lent, 2016, p. 17), they require the awareness of text structures and how they are created and utilized. Readers of a math text need to be aware of their self-monitoring skills (Shepherd & van de Sande, 2014) in order to “make notes of misconceptions or confusion” (Lent, 2016, p. 18). For readers of social studies texts to “untangle threads of fact from often conflicting accounts and perspectives” (Lent, 2016, p. 19), they must be able to analyze and evaluate what they read. To effectively “find underlying messages that evolve as a theme” (Lent, 2016, p. 20), readers of ELA texts require the ability to infer.

Although I can describe the literacy practices revealed in the think alouds, the participants could have automatically used the other Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014) characteristics but may not have thought to reveal them. For each discipline-specific section, I demonstrate the participants’ use of literacy practices as described by Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014). Although I list the literacy practices in the order provided by Lent (2016),

the order of these practices as given below does not reflect a sequence of events or the importance of the practice.

Reading Like a Scientist (Science)

As a science discipline-specialist, Goodall displayed several of the reading characteristics described by Lent (2016, p. 17) while reading her most challenging text. First, Goodall took “an objective stance” (Lent, 2016, p. 17) as she read and tried to learn from what Lin et al. (2017) were explaining. With that said, to understand the text, Goodall needed to apply her background knowledge and experience to the new information. When accessing their background knowledge, many readers cannot completely turn off their subjectivity. Second, Goodall asked relevant questions (Lent, 2016, p. 17) as she read. Across the disciplines, questioning is an excellent way to stay engaged with a text. In science, for example, questions are an important component of engaging with the scientific method.

Third, and interestingly, the majority of Goodall’s questions were related to unknown vocabulary. In addressing this, she connected to the aspect, “decipher vocabulary necessary for conceptual understanding” (Lent, 2016, p. 17). For example, she questioned the definition of the words “nanosphere” and “galinstan,” and did not read further in the article until she had grasped the meaning of the words. To find the definitions she needed, Goodall went beyond the Lin et al. (2017) text, to Google. Fourth, as Goodall was deciphering the content of the article, she questioned the “reasoning and conclusions” (Lent, 2016, p. 17) presented by Lin et al. (2017). Goodall questioned the use of Lin et al.’s (2017) findings in an industrial setting. In order to question, a reader needs to synthesize both new and old information, and to apply knowledge.

Fifth was Goodall’s employment of the characteristic of paying “attention to details and numbers” (Lent, 2016, p. 17). She was conscious of the temperature variances, as well as the

time it took for changes to appear, as shown in the article's data. Sixth was the characteristic that involved diagrams (Lent, 2016, p. 17) provided by Lin et al. (2017), which aided Goodall's understanding of the data. Goodall was aware of the difference of using of black and white photos compared to colour photos. She found that the black and white photos made it easier to recognize changes. She also used the diagrams to help her understand the text of the article. Seventh, Goodall noticed that Lin et al. (2017) used references to "collaborate with colleagues when faced with complex ideas" (Lent, 2016, p. 17). Eighth, and finally, Goodall used illustrations (Lent, 2016, p. 17) provided by Lin et al. (2017) to see the bonding that took place in the experiment.

Goodall's view of the authors corresponded with Shanahan and Shanahan's (2012) idea that science discipline specialists try to focus on the text itself, rather than on authors, because the reliability and validity of the science within the text are more important than the author's ideas or bias. When reading biology and chemistry journal articles, Goodall mentioned very little about the authors which coincides with the views of Shanahan and Shanahan (2012). For example, while reading "Therapeutic treatment of Marburg and Ravn virus infection in nonhuman primates with a human monoclonal antibody" (Mire et al., 2017), Goodall commented that the authors had written a scientific article. She explained, "I love the fact with a scientific article you basically have an idea of what they're going to tell you and how successful they were." Maybe the fact that she made so little reference to the authors while reading the science-rich articles was due to her being a disciplinary expert in teaching and its nonvernacular social language (Gee, 2014). It was when Goodall read the more informative teaching-related articles that she commented more extensively about the authors. Because Goodall has done a great deal

of ELA teaching, her familiarity with that genre may have come into play when reading all her texts for this research.

In demonstrating Lent (2016) and Shanahan and Shanahan's (2008) science-specific reading characteristics, Goodall employed various content-based literacy practices, including reading skills and strategies and reading processes. These included using her background knowledge, synthesizing, summarizing, asking questions, finding the meaning of difficult words, and having intrinsic motivation, as well persevering and being curious.

Reading Like a Historian (SS)

As a SS discipline specialist, Elizabeth demonstrated most of Lent's (2016) characteristics when reading her most difficult text. Comparing and contrasting events, accounts, documents, and visuals such as infographics or photographs (p. 19) was the first characteristic Elizabeth used. For example, she compared and contrasted the events of Lenin's life that were stated by Ralph and Lerner (1990) to her own background knowledge. Elizabeth did not voice her use of pictures and editorial cartoons (Lent, 2016, p. 19) until I asked her about them. She took it for granted that students knew how to read and decipher visuals. Once I highlighted the importance of talking about the various images, Elizabeth was able to expand on her use of them. She was also able to explain them in later think alouds. Second, Elizabeth was cognizant of the need to "interpret primary and secondary sources with an eye toward bias" (Lent, 2016, p. 19). She was leery of the bias that Ralph and Lerner displayed in their evaluation of Lenin as an influential revolutionary and an able leader, administrator, and strategist, who demanded respect and loyalty. This ability to be aware of the author's biases concurs with Shanahan and Shanahan's (2012) ideas about how history teachers view authors. Third, in examining Ralph and Lerner's view of Lenin, Elizabeth untangled "threads of fact from often conflicting accounts

and perspectives” (Lent, 2016, p. 19). Fourth, when comparing the knowledge of Lenin’s life that is available now to what was available at the time Ralph and Lerner wrote, Elizabeth was using “knowledge of the present to make sense of the past and vice versa” (Lent, 2016, p. 19). Fifth, Elizabeth repeatedly situated “new understandings within background knowledge” (Lent, 2016, p. 19). Sixth, she continuously evaluated and positioned Ralph and Lerner’s information and explanations alongside her already broad understanding of the subject matter (Lent, 2016, p. 19). Seventh, in recognizing that Ralph and Lerner were missing some information from Lenin’s life timeline, Elizabeth demonstrated thinking “sequentially to piece together timelines” (Lent, 2016, p. 19). Eighth, and finally, she demonstrated the ability to “make inferences and determine what is important from what is merely interesting” (Lent, 2016, p. 19) when she speculated as to why Ralph and Lerner omitted certain information about Lenin’s life. Elizabeth also demonstrated a historian’s reading skill that Shanahan and Shanahan (2008) highlight, the ability to infer cause and effect when studying events and what precedes and follows them (p. 56). Elizabeth looked for cause and effect a few times. She looked back in the reading to find the causes of actions to which the authors refer.

One of Lent’s (2016) characteristics that Elizabeth did not voice was determining “meanings of words within context” (p. 19). She did not articulate difficulty with vocabulary. Elizabeth may have known all the words or just automatically (Gal’perin, 1969; Bodrova & Leong, 2007; Rawson, 2010; Samuels et al., 2006) used her ability to understand word meanings from their context.

As Elizabeth read her social studies-specific texts, she employed the historian reading characteristics outlined by Lent (2016) and Shanahan and Shanahan (2008). She used many content-based literacy practices, including strong background knowledge as well as synthesizing,

inferring, analyzing, summarizing, paraphrasing, visualizing, and applying to practice the historian reading characteristics that Lent (2016) and Shanahan and Shanahan (2008) suggest.

Reading Like an English Major (ELA)

The ELA discipline-specialist, Carmen, demonstrated many of Lent's discipline-specific reading characteristics when she read. The first was looking for "ways that characters, setting, and conflict may influence the meaning of the text" (Lent, 2016, p. 20). Carmen was familiar with the historical context of this historical fiction novel and understood how the culture of the time would allow the conflict and actions of the characters and influence the text meaning. As a fan of Machiavelli, she understood his logic and the reasons for his behaviour. Second, Carmen demonstrated two characteristics simultaneously, in that she understood "the use and effect of figurative language" (Lent, 2016, p. 20) as well as recognized "devices authors use to enhance their writing, such as flashbacks, hyperbole, or analogy" (Lent, 2016, p. 20). Carmen recognized the allusion to *The Three Musketeers* (Dumas, 1878). She stated, "I wonder if it is a different version Athos, Porthos, and Aramis [*The Three Musketeers*' protagonists]. The D'Artagnan used seems to be a giveaway, but half of me feels that's too easy. I don't know."

Third, Carmen "read skeptically, discerning unreliable narrators or characters" (Lent, 2016, p. 20). She found it challenging to keep track of the narration. The way Rushdie organized the narration made it difficult for Carmen to follow it. Fourth, in the case of this fiction work, Carmen summarized and synthesized events (Lent, 2016, p. 20). She gave a summary of the antecedent information in the novel before reading this chapter. She then synthesized events from this chapter with events that took place earlier in the novel. Fifth, Carmen made connections to understand real-world issues (Lent, 2016, p. 20)—for example, connections to twirling dervishes, as well as to a Jeopardy question regarding Marv (noting that it is a place

stated in the novel that actually exists). She wanted to get a better understanding of both the real spiritual and geographical connections of a particular region stated in the novel.

Sixth, Carmen used “text structure as a tool for comprehension” (Lent, 2016, p. 20). She explained how “The stuff in italics, the regular text, is what Akbar the Great is relaying as the story. The italics are the interjection from his listeners.” Seventh, Carmen paid “attention to new vocabulary or how words are used in unusual ways” (Lent, 2016, p. 20). When she came across *qizilbash*, she was curious about the meaning and Googled the definition. Eighth, and finally, engagement “in a mental dialogue with the author” (Lent, 2016, p. 20) took place. She questioned Rushdie’s view of women and whether he liked them. Another instance is that she questioned Rushdie concerning his storytelling ability. She found the whole book to be challenging and a bit difficult to follow.

As Rushdie’s novel is fiction, Carmen did not employ reading “nonfiction critically, looking for biases or fallacies in reasoning” (Lent, 2016, p. 20). However, when she read any non-fiction texts during other think alouds, this characteristic was evident. Also, I did not identify that Carmen recognized “underlying messages that evolve as a theme” (Lent, 2016, p. 20). Carmen’s view of the texts’ authors corresponds with Shanahan and Shanahan’s (2012) explanation that some scholars recommend a close reading of the texts. In contrast, others would advise readers to consider the authors and their backgrounds and ideas.

In applying various English major reading characteristics suggested by Lent (2016) and Shanahan and Shanahan (2012), Carmen used several content-based literacy practices, including reading skills, strategies, and thinking processes, to read her English language arts-specific texts. These practices included her vast background knowledge, summarizing, self-monitoring,

analyzing, understanding difficult words, and going beyond the text for better comprehension. Carmen also had a sense of humour, intrinsic motivation, curiosity, and perseverance.

Reading Like a Mathematician (Math)

Gosset, the math discipline-specialist, demonstrated the use of many Lent's math discipline reader characteristics while reading her most onerous text (Kopf, 2015) as well as the mathematical text (Burton, 2013). First, Gosset made "meaning out of mathematical symbols and abstract ideas" (Lent, 2016, p. 18). She understood and could explain the z -distribution and the standard normal distribution of curves (Kopf, 2015). Gosset could also look at and explain what an equation represents. She explained:

If you look at that equation, there are very few people that can see what it is. I can tell you what I think this graph says even though it's a bit messed up. I see that there is a constant in front of an integration, and I see that I'm going from negative infinity to some value of x , and then I've got some function of eight to the power of negative $7x$ squared over dx , so I know this is calculus.

In the Burton (2013) text, Gosset additionally demonstrated "meaning out of mathematical symbols and abstract ideas" (Lent, 2016, p. 18; Shepherd & van de Sande's, 2014). She stated that she knew what the product of two quadratic equations is supposed to look like to get to that quadratic function:

So, I understood where these are coming from and I didn't have to do the proof of it; I also didn't to do the expansion because I know that it is just multiplying each one of these terms out and collecting like terms; to do this is going to be 123456, 246. There will be 3, 6, 9, 12 different terms. I would have to expand them all out and then combine them all. And it would take half a page. I know how to do it and that's why I can skip it.

Second, Gosset sought “to understand what the problem is asking them to do rather than reading only for information” (Lent, 2016, p. 18). When there was a question regarding mathematics in both articles, she eagerly tried to understand the problem and would complete the math to solve it.

Third, she frequently asked questions as she read (Lent, 2016, p. 18) both texts. This question-creating would sometimes be voiced as “I wonder...” Fourth, Gosset readily made notes or drew pictures on both texts or in a notebook. She did this to “make notes of misconceptions or confusion” (Lent, 2016, p. 18). The fifth characteristic Gosset employed was reading “for accuracy and clear mathematical reasoning” (Lent, 2016, p. 18). This characteristic was imperative to Gosset’s reading of both texts; all the math had to be accurate. Sixth, Gosset scrutinized the ways that math was “reported in the media or in real-world applications” (Lent, 2016, p. 18). She found it disturbing that Kopf (2015) would even consider math to be scary.

Seventh, Gosset’s application of using “previously learned mathematical concepts” (Lent, 2016, p. 18) was observed often throughout both readings. For the Kopf (2015) text, she readily recognized and applied her understanding of different types of distribution, and of graphs and charts. Gosset even had a copy of the original *t*-distribution table on a shelf in her classroom. While reading the Burton text (2013), she stated that she knew what the product of two quadratic equations is supposed to look like to get to that quadratic function.

Eighth, and finally, Gosset thought “about how vocabulary may be used differently in math contexts” (Lent, 2016, p. 18). There were times where she needed to know the definition of difficult words, and then she applied those words to the math context (for example, the word “saccharine”). When reading her “math-heavy” articles, Gosset reread texts to ensure she understood words with what Shanahan and Shanahan (2008) explain as “the precision of

meaning, and each word must be understood specifically in service to that particular [mathematical] meaning” (p. 49). For example, when reading “Student’s t distribution” (Ahsanullah et al., 2014), Gosset was cautious to ensure she understood the meaning of “fat-tailed distributions” (p. 52) within the article’s context.

While reading the other think-aloud texts, Gosset repeatedly showed her ability to make “meaning out of mathematical symbols and abstract ideas,” (Lent, 2016, p. 18; Shepherd & van de Sande; 2014) act as an investigator “looking for patterns and relationships,” “read for accuracy and clear mathematical reasoning,” and use the information being read “as pieces of a puzzle to be solved,” (Lent, 2016, p. 18). When reading mathematical articles, Gosset did comment about the authors which seemed to assist her comprehension. This commenting contradicts Shanahan and Shanahan’s (2012) views of how a mathematician views the authors of texts. For example, when not understanding a portion of her first think aloud, “The algebraic aspect of *La Géométrie*” (Burton, 2013), she queried, “Why would he do that?” A number of times Gosset pondered or questioned why Descartes (whose proof was the focus of the article) did what he did with the proof. Of any of the authors, she addressed Kopf (2015) the most frequently. This article contained the least math. Perhaps her addressing of the authors while reading the math-rich articles was due to her being a disciplinary expert in teaching and its pedagogical Discourse. Or possibly, because Gosset had struggled with reading, she was very aware her need to question while reading. Gosset’s reading proficiency includes her whole background as discipline specialist, teacher, and struggling reader.

When reading both articles, Gosset used Shepherd and van de Sande’s (2014) three dimensions that contribute to successful comprehension of mathematical exposition: mathematical fluency, comprehension monitoring, and engagement (p. 77). Gosset was aware of

her comprehension and performed frequent, multiple self-monitoring checks, which confirms Shepherd and van de Sande's (2014) summarization of expert math readers. Gosset had the perseverance and willingness to repair her lack of comprehension. Gosset also was willing to search "external sources to refresh and review their understanding of unfamiliar or forgotten concepts" (Shepherd & van de Sande, 2014, p. 83).

In applying the various mathematic-specific reading characteristics suggested by Lent (2016), Shanahan and Shanahan (2012), and Shepherd and van de Sande (2014), Gosset used a variety of content-based literacy practices. As demonstrated in Chapter [Four](#) and Appendix P, these included accessing her considerable background knowledge, synthesizing, inferring, analyzing, visualizing, note-taking, and predicting. These literacy practices coincide with what Fang and Chapman (2020) discovered in their case study. Gosset also demonstrated intrinsic motivation, perseverance, and curiosity.

As presented above, the participants demonstrated the use of various discipline-specific literacy practices. Their use of content-based literacy practices, such as synthesizing, inferring, understanding vocabulary, visualizing, summarizing, and self-monitoring helped in their use of discipline-specific literacy practices (Di Domenico et al., 2018; Faggella-Luby et al., 2012). There were, however, instances while reading other think alouds when they used different literacy practices to engage with the texts. One of these was the use of analogies, which fits under Lent's ELA category and states it is used to "recognize devices authors use to enhance their writing, such as flashbacks, hyperbole, or analogy" (Lent, 2016, p. 20). Both Goodall and Carmen used analogies to explain what they were reading. According to Marzano (2004), analogy creation requires "an in-depth knowledge of content; the use of analogies is one of the most complex activities using similarities and differences" (p. 76). A correctly formed analogy

indicates that the person understands the subject matter so well that they can make another representation of it, which represents concept connection at higher levels of thinking. The capacity to reason using analogy creation is related to the ability to draw inferences from what is read or discussed.

The participants used many of the discipline-specific reading characteristics that Lent (2016) and Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014) indicate. Goodall, Elizabeth, Carmen, and Gosset often utilized similar reading skills, strategies, and thinking processes to employ the characteristics of Lent, Shanahan and Shanahan, and Shepherd and van de Sande. These content-based literacy practices included: using their background knowledge, applying self-monitoring to ensure they were understanding, synthesizing, analyzing, inferring, questioning, understanding difficult words, going beyond the text to understand, and displaying intrinsic motivation, as well as persevering and being curious. The participants used them, but each in different ways, to understand the discipline-specific texts. Interestingly, the participants often unconsciously used various literacy practices and reading characteristics mentioned by Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande (2014).

When teaching discipline-specific literacy, Fang (2012b) emphasizes the need, beyond the generally accepted focus on basic skills, general cognitive, and generic learning strategies, “to embrace an emphasis on discipline-specific practices that promote simultaneous engagement with disciplinary language and disciplinary content” (p. 19). That said, it would also be helpful if teachers were more cognizant of their metalinguistic awareness while using content-based literacy. For example, knowing when to infer, synthesize, apply, or sequence. If teachers can articulate their content-based literacy as it relates to disciplinary literacy, it could increase

students' understanding of how to read discipline-specific texts more effectively and efficiently. Some students need to address gaps in their content-based literacy which can impede their engagement with discipline-specific texts.

I emphasize that, yes, the participants engaged with discipline-specific texts as a scientist, a historian, an English major, or a mathematician, but the automaticity of reading practices hindered their communication of these practices. Accordingly, it would be helpful to ensure that teachers are teaching discipline-specific literacy practices in their classes. In the next chapter, I explore this question as I consider the implications of this research. I explain the implications for the participants as well as the implications for in-service teachers, pre-service teachers, and policy-makers and administrators. These implications will, most importantly, impact student learning and the ability for students to read as discipline-specialists.

Chapter Summary

In this chapter, I discussed three dominant reading themes: (a) literacy practices—reading skills, strategies, and thinking processes; (b) cognizance of literacy practice use; and (c) reading as discipline specialists. These themes reflect that engaging with texts is a sociocultural event that takes into consideration a reader's milieu, which is a lens used to understand the text. The reader's background knowledge and experience are as important as the author's words and intent.

Within the first theme, I emphasized the participants' use of private speech, purposes for reading, and reading stances and interactions with authors. In the first theme, I also highlighted the literacy practices employed by each participant, including a strong dependency on background knowledge or personal associations that was imperative to text understanding. In the second theme, I emphasized the automaticity of literacy practices along with the untapped

awareness of discipline-specific reading Discourse or nonvernacular social language (Gee, 2014). The final theme revealed was how the participants read discipline-specific texts as a scientist, historian, English major, or mathematician.

The significant thread that runs through these themes is that all the participants were accomplished readers whose literacy practices were automatized (Godde et al, 2020; Kuhn et al., 2010; Bodrova & Leong, 2007; Gal'perin, 1969; Samuels et al., 2006); this reduced the frequency in voicing every aspect of their metalinguistic awareness. Automaticity while reading is important for effective and efficient readers, but it is the lack of consciousness when teaching that needs to be addressed so that secondary discipline specialists will be able to instruct students how to read like a discipline-specialist. Teaching disciplinary literacy may be more effective if educators can make explicit the implicit aspects of their thinking. In Chapter [Six](#), I outline my research's contributions to both scholarship and pedagogy.

Chapter Six: Contributions to Scholarship and Pedagogy

Disciplinary literacy teaching is not about producing new members of the disciplines (although it surely will produce some new members, and perhaps some from a range of diverse backgrounds) but about providing all students with the opportunity to understand how disciplines work. (Moje, 2015, p. 259)

The purpose of embarking on this qualitative research journey was to understand how secondary discipline specialists engage with discipline-specific texts. When teacher specialists read discipline-specific texts, they need to be mindful of their own metalinguistic awareness. This mindfulness will ensure they have the pedagogical tools to embed this cognition into their teaching practice so they can more easily instruct students how to engage with texts as discipline specialists. This would provide all students with the opportunity to understand how disciplines work. (Moje, 2015, p. 259). Discipline-specific reading is situated in complex sociocultural systems that shape and support reading (Gee, 2012). To understand and use disciplinary language reflects a sociocultural perspective (Moje, 2015) because each discipline has its own culture (Perry, 2012; Howell, 2021;), genres, learning tools (Moje, 2015; Gee, 2013), communication styles, assessment standards, and nonvernacular social language (Gee, 2014). My contributions to scholarship and pedagogy give added insight into how reading can be better understood by secondary discipline specialists.

The chapter is organized into two sections: contributions to scholarship and contributions to pedagogy. I begin with contributions to scholarship. This is followed by implications for three aspects of pedagogy that impact the education of secondary students: (a) changes to in-service teacher professional learning (PL); (b) changes to pre-service teacher education; and (c) changes to decisions made by policy-makers and administrators. The chapter will end with a reflection, suggestions for further research, and some concluding comments.

Contributions to Scholarship

In this section, I explain the theoretical and methodological contributions of my research. This research is significant because much of the scholarship to date has focused on how secondary teachers teach literacy practices. Although some research has emerged on discipline-specific literacy, the research does not inquire into how secondary teachers think about their text engagement process.

Reader Stances

In Rosenblatt's (1978, 2013) transactional theory, she maintained that readers of fiction texts would position themselves predominantly using the aesthetic stance. Readers of non-fiction would situate themselves primarily using the efferent stance. As the participants in this study read non-fiction texts, at times they positioned themselves aesthetically as well as efferently. Their love for the subject matter was as important as their motivation to gather information. In their information gathering, the aesthetic stance seemed to have occurred simultaneously with the efferent stance, blurring the stances together. The significance of the two stances together seems to be more pronounced than the stance-within-stance position of Paulson and Armstrong (2009). The participants' main goals for reading the texts were to gain information and to demonstrate their metalinguistic awareness; however, because they enjoyed reading the discipline-specific information, the aesthetic stance was apparent as they read efferently. The simultaneous positioning of stances to understand non-fiction texts would be important to emphasize in secondary disciplines where texts are predominantly non-fiction. If secondary discipline specialists model their passion for texts, it might create a greater interest in the subject matter among students, increasing their motivation to learn the content.

Cognizance of Literacy Practice Use

As a teacher and researcher, I have experienced, witnessed, and read many ideas that have been put forward about how to improve the reading skills of secondary students. The majority of them have involved teaching generic content-based literacy practices in all classes. One way to improve the effectiveness of instruction is by looking at and considering some important aspects of teacher metalinguistic awareness. According to Gilles et al. (2013), educators' increased metalinguistic awareness as readers will increase self-efficacy with content literacy practices. Teachers need to become more aware of how they engage with discipline-specific texts. From my research, important findings have emerged that can influence how secondary discipline-specialists understand their engagement of discipline-specific texts; this would give them additional specific language to communicate the discipline-specific literacy practices necessary for students to better understand the texts. These findings fall under the category of cognizance of literacy practices use or discipline-specific metalinguistic practices. As Gee (2002, 2013) points out, there is specific language used in specific situations that he refers to as Discourse or *nonvernacular social language* (Gee, 2014, p. 23).

In the context of my research, to communicate the necessary literacy practices needed to comprehend discipline-specific texts, it would be beneficial for teachers to routinely use discipline-specific metalinguistic practices. Additionally, discipline specialists could benefit from further awareness of the literacy practices they use—how to make the implicit, explicit. However, teachers often take these literacy practices for granted and are not conscious of the value of verbalizing and teaching these practices. There are many secondary students who struggle with reading discipline-specific texts (Spires et al., 2018; Jetton & Shanahan, 2012; Fang, 2012c). According to Fang (2012c), as students move through secondary school, “the

language used to construct and challenge specialized knowledge ... becomes more technical, dense, abstract, and hierarchically structures” (p. 35). For struggling readers, it may be helpful for teachers to model how they successfully engage with texts. As demonstrated by the participants, the main reason for this unawareness is the automaticity (Godde et al, 2020; Kuhn et al., 2010; Bodrova & Leong, 2007; Gal’perin, 1969; Samuels et al., 2006) of their metalinguistic awareness. Rather than making thinking explicit, discipline specialists overlook the fact that students may not already know how to use literacy practices. I propose possible solutions to assist in building discipline-specific literacy practice repertoire.

Literacy Practice Discourse. As demonstrated in this research, the participants read texts efficiently and effectively. They understood the texts and used various literacy practices to understand them. Gee (2002, 2013) points out that specific language is used in specific situations, which he calls Discourse or *nonvernacular social language* (Gee, 2014, p. 23). Although all the participants were competent readers, they did not always think to use the literacy practice Discourse I expected them to use, to label what they did as they read. In the context of my research, literacy practice Discourse refers to the specific language used to explain the thinking that occurs as texts are being read. More specifically, Lent (2016), Shanahan and Shanahan (2008, 2012), and Shepherd and van de Sande’s (2014) discipline-specific reading characteristics are examples of what I would describe as Discourse that discipline specialists use to read successfully. In order to use these characteristics effectively, readers need to use a variety of literacy practices, including reading skills, strategies, and thinking processes. The participants were able to discuss their metalinguistic practices but could have communicated their thinking more effectively by using literacy practice nonvernacular social language. Using consistent

literacy practice Discourse applied to discipline-specific texts could improve students' understanding of their own metacognition.

The participants' limited awareness of all disciplinary literacy Discourse is related to situated language as described by Gee (2013). He states that, "meaning in language is tied to people's experience of situated action in the material and social world" (p. 136). Reading a discipline-specific text is a specific situation in which the reader needs to comprehend the content. Packer and Goicoechea (2000) state that "learning involves 'enculturation': picking up the jargon, behaviour, and norms of a new social group; adopting its belief system to become a member of the culture" (p. 229). Each discipline-specific classroom has its own culture. The participants are discipline specialist teachers, but not literacy specialists. The Discourse expected in these two areas can differ. Each participant explained their thinking, often not providing content-based literacy Discourse specifically to address their engagement. Content-based literacy Discourse is foundational to disciplinary literacy (Shanahan & Shanahan, 2008; Faggella-Luby et al., 2012; Paul, 2018; Tang, 2016). Teachers not only have to understand text content; they also need to explain how to read the discipline-specific texts to students. If they have the appropriate nonvernacular social language (Gee, 2014) to explain their thinking, it will be easier to teach this. Gee (2004) explains, "At best [schools] believe you can teach children to think (e.g., about science and math) without worrying too much about the tools children do or do not have with which to do that thinking" (p. 3). Students are not able to finish high school without the use and understanding of discipline-specific Discourse (Gee, 2004).

As previously discussed, the participants in this research may not have used the language I anticipated to explain their thinking. Many secondary teachers have had little education or PL focussing on their metalinguistic awareness. By understanding their thinking as they use the

various literacy practices, secondary teachers will have more purposeful and applicable pedagogical strategies to teach the necessary Discourse for a particular discipline. It may be helpful for teachers to understand the literacy practices—including content-based literacy—needed to effectively engage disciplinary literacy. Following are examples of applied content-based literacy needed to understand discipline-specific texts. A reader of science requires the ability to synthesize and analyze (content-based literacy) to “search for answers to relevant questions” (science disciplinary literacy) (Lent, 2016, p. 17). A reader of a mathematical text requires the capability to apply (content-based literacy) knowledge so they can translate and articulate words and symbols (mathematical disciplinary literacy) (Shepherd & van de Sande, 2014). A historical text reader requires the ability to sequence ideas (content-based literacy) in order to “think sequentially to piece together timelines” (SS disciplinary literacy) (Lent, 2016, p. 19). Someone who comprehends an ELA text requires the ability to infer (content-based literacy) so they have the ability to “look for ways that characters, setting, and conflict may influence the meaning of the text” (disciplinary literacy) (Lent, 2016, p. 20). Self-monitoring (content-based literacy) is another reading practice that is required by all discipline readers to recognize and fix breaks in comprehension. The readers need discipline-specific understandings to recognize when they have lost comprehension. Additionally, readers of all disciplines make connections to background knowledge (Neuman et al., Kaefer, & Pinkham, 2014; McVee et al., 2013; Marzano, 2004; Langer, 1984) to comprehend texts. Having the metalinguistic awareness of these connections may empower teachers to communicate the connection-making to their students.

The overlapping of content-based literacy and disciplinary-literacy strategies causes the distinctions between the increasing specialization of literacy development (Shanahan & Shanahan, 2008; Faggella-Luby et al., 2012; Paul, 2018; Tang, 2016) to be less clear. A reader’s

capability to successfully use content-based literacy will support their ability to successfully employ the specific practices that specialists use to engage with disciplinary texts (McCarty & Degener, 2018). The use of content-based literacy and disciplinary literacy often happens simultaneously.

Awareness of Useful Literacy Practices. In order to read and understand various texts, secondary discipline specialists need to employ a variety of literacy practices. One of the issues participants had in articulating the literacy practices they used was their limited awareness of all the nonvernacular social languages. Although they used the practices, they did not know the importance of communicating them. For example, it was not until I asked about the participants' use of visualization that they stated they did visualize. Additionally, the participants did not articulate their awareness of text features. Like many secondary teachers, Elizabeth assumed her students would know how to read graphs, maps, and editorial cartoons, so she did not think to voice how she read them until I asked her about this. Goodall explained the importance of illustrations and diagrams only after I asked her about them. The automaticity of thinking is an untapped resource that would be helpful in making implicit thinking, explicit. To be better equipped to understand their own metalinguistic awareness, this research shows that teachers need to be given the opportunity to articulate their thinking in order to become aware of their metalinguistic awareness.

Automaticity of Metalinguistic Awareness. One possible reason the participants did not think to voice all the literacy practices they used as they engaged with discipline-specific texts is explained by scholarship on automaticity (Gal'perin, 1969; Bodrova & Leong, 2007; Rawson, 2010; Samuels et al., 2006; Godde et al., 2020; Roembke et al., 2021; Kuhn et al., 2010). When readers such as my participants become proficient, automated practices that enable reading

comprehension transpire so effortlessly and so quickly that readers are often unaware that automatic inferences are being formulated (Samuels et al., 2006). It was difficult for each participant to make internal language external; each one demonstrated more literacy practices than what they voiced. Through explaining their thinking, they revealed that they did not have the specific vocabulary to explain the literacy practices they used (including synthesizing, applying, self-monitoring, etc.). They found it difficult to explain everything that went through their minds as they read. Their language had become what Vygotsky (1987) called “folded,” meaning that as a person thinks of many ideas at one time, they may not be aware of all the thinking that is happening simultaneously.

Bodrova and Leong (2007) suggest that thinking needs to become “unfolded” (p. 70) so all the thoughts can be brought into consciousness. Cleeremans et al. (2020) explain that the brain can learn consciousness (p. 112). As demonstrated in my research, a promising solution to automaticity, or lack of consciousness, would be for readers to verbalize their thinking and to have their thinking reflected back to them, making the unconscious, conscious, or the implicit, explicit. The process of making the unconscious, conscious takes time and effort. Michelson and Bailey (2016) emphasize the necessity for content area teachers to understand their discipline-specific reading processes because lack of understanding can make it difficult to teach such processes to students.

Possible Solutions to Discipline-Specific Literacy Practice Needs. For the participants, as for most proficient readers, many of the literacy practices used had become automatized (Gal’perin, 1969; Bodrova & Leong, 2007; Rawson, 2010; Samuels et al., 2006). This could be a reason why they did not think to use the appropriate nonvernacular social language (Gee, 2014) with which to label them all. They understood the concepts but did not have the vocabulary to

name them. Each participant comprehended texts using discipline-specific literacy practices. They, however, did not verbalize the content-based literacy practices, that is, the intermediate literacy category (Shanahan & Shanahan, 2008) used to enable them to use discipline-specific literacy. Once teachers are aware of the literacy practices they already use, they could be empowered to teach discipline-specific literacy more effectively.

To do this research, I needed to meet the participants in their zone of teacher proximal development (ZPTD) (Warford, 2011). Warford (2011) emphasizes the need for teachers to be given the space to use their background knowledge and experience in their learning. Teachers benefit when being provided the opportunity to create their own frame of reference and professional action in a situation (Fani & Ghaemi, 2011). I first needed to have access to their thinking, which was made accessible through the use of think aloud. After listening and transcribing a couple of think alouds, I was able to recognize the literacy practices used. I was then able to label the literacy practices employed and reflect them back to participants. As previously mentioned, after transcribing the first couple of think alouds, I was also able to see that there was not any mention of other literacy practices such as visualization and recognizing text features. When I asked the participants if they visualized, or how they read text features, they became cognizant of their use. The participants then began to verbalize their visualization and their use of text features in later think alouds.

One of the concerns that arose from the data collection was during the follow-up interview the participants were not able to tell me all of the literacy practices they used even after my interaction with the participants through five or six think alouds. This tells me three important things. The first is that their thinking was still automatized or unconscious. The second is that they needed more examples of when they used the literacy practices. The third factor is

that it takes time for the automaticity of thinking to become conscious. Each teacher must make a concerted effort to become aware of discipline-specific literacy metacognition.

Think Aloud as a Research Tool

Through this research, think aloud was an invaluable data collection tool. As a mechanism that allowed the participants to communicate reading thinking, participants needed to be able to formulate the thoughts with which to communicate their thinking. Several researchers have shown that think aloud is an effective means by which to collect data (Manderino, 2012a, 2012b; Shanahan et al., 2011; Charters, 2003; Pressley & Afflerbach, 1995). My research confirmed these findings as I inquired into how secondary discipline specialists engage with discipline-specific texts. Think aloud was the method by which the participants revealed what they were thinking.

For example, Shanahan et al. (2011) used think aloud in their study to explore “how historians, chemists, and mathematicians differ in how they read texts in their fields, including texts they use themselves within their work and the texts that are meant to be used by high school students” (p 405). They found the use of think aloud instrumental in their study. As with the research conducted by Shanahan et al., think aloud revealed the thinking of my participants and was an intricate part of this research. Without it, I would not have been able to investigate the metacognition that takes place as secondary disciplinary specialists engage with texts. Furthermore, I would have not been able to recognize the degree to which the automaticity of their literacy strategies hindered their ability to voice the literacy practices they employed. My research contributes to the importance of automaticity when using think aloud as a research tool.

Having a think-aloud protocol already established helped communicate what was expected from the participants during data collection think alouds. As pointed out by Migyanka

et al. (2005), think aloud requires practice. During the first couple of think alouds, both the participants and I needed to get used to each other's ways of communicating during the process. Carmen had a difficult time during her first think aloud with being able to tell me where she was in the think-aloud process. She would talk about what she was thinking, but did not indicate the place in the text to which she was referring; as a result, I was unable to mark the spot on my copy of the text for later transcription and analysis. By the second think aloud, with some gentle reminders, Carmen became more adept at this communication. As well, the other three participants needed similar reminders during the first couple of think alouds. Additionally, they had to practice verbalizing thoughts—inner voice. With practice, each participant became more competent at communicating where they were in their readings and at putting thoughts into words. For example, Elizabeth, during the last think aloud, was very careful to identify the place from which she was reading. She would give the column and section of that column before explaining her thinking.

My research highlights the importance of think alouds as valuable data collection tools, keeping in mind that the participants needed the opportunity to practice exactly how to think out loud. Researchers also need to be aware of the automaticity (Godde et al, 2020; Kuhn et al., 2010; Bodrova & Leong, 2007; Gal'perin, 1969; Samuels et al., 2006) of the participants' metalinguistic awareness. By examining discipline specialists' cognizance of literacy use through think aloud, my research contributes to scholarship by emphasizing the importance of teachers' awareness of how they think as they read discipline-specific texts. Development of this awareness takes time and support.

Contributions to Pedagogy

According to Hinchman and O'Brien (2019), there is a need for change in the way disciplinary literacy has been taught. Over the last few decades, having teachers infuse teaching and learning strategies to instruct students has not been that successful (p. 525). I concur with Gilles et al's (2016) statement, "it is time to empower teachers by encouraging them to rethink their own literacy, tap into their strengths, and collaborate with others for the good of their students" (p. 682). In an ideal secondary classroom, students would be immersed in discipline-specific learning where teachers are passionate discipline specialists who understand and teach how to think, read, write, view, represent, speak, and listen as discipline specialists. Rainey and Moje (2008) explain the importance of teaching disciplinary literacy:

Each discipline has unique ways of asking questions and solving problems. Similarly, each discipline has unique expectations for the types of claims that are made and the way those claims are supported. These differences play out in the ways that texts are written and in the demands those texts place on the readers. For these reasons, we can say that each discipline has its own discourse community, a shared way of using language and constructing knowledge. (p. 73)

Leaders in our education systems need to assist teachers to more successfully develop and nurture discipline-specific-rich secondary classrooms. Some promising possibilities to equip teachers have emerged through my research, such as the automaticity of teachers' metalinguistic awareness. Teachers' metacognition needs to be brought to the forefront of their thinking for them to be able to describe how they engage with their texts.

It would be helpful for teachers to be aware of and know how to articulate discipline-specific reading practices so they can more effectively teach students to engage with discipline-

specific texts. Most secondary discipline specialists can successfully read discipline-specific texts. If these teachers are aware of their abilities to engage with discipline-specific texts, they may be better equipped to teach students how to read and think as discipline-specialists.

Within this section, I explain the pedagogical contributions of my research. The first part highlights the implications of this research for each participants' practices in the classroom. The second part emphasizes recommendations for practice considering in-service teacher education, pre-service teacher education, and policy-maker and administrators' responsibility.

Implications for Teachers

One of the reasons I started this research was to find ways to help teachers take ownership of students' literacy abilities within discipline-specific classrooms. This concern is related to the content-literacy dualism that various scholars (e.g. Brozo et al., 2013; Malmström & Pecorari, 2021) have explained. This dualism is a result of a divide between literacy experts' expectations that content teachers will teach literacy practices within content areas and the resistance that many content teachers feel toward teaching literacy practices. In their literature review that included literacy across the disciplines, Scott et al. (2018) emphasize that "... over the course of almost five decades in this field, the integration of literacy across the disciplines continues to be met with resistance" (p. 9). Hinchman and O'Brien (2019) explain, "The road disciplinary literacy has traveled to date has been marked by justifiable subject-area teacher resistance to requirements to infuse literacy teaching and learning strategies into their teaching without regard for disciplinary epistemologies or local perspectives" (p. 525). Content-literacy dualism is significant because many secondary teachers lack education about how to teach literacy in classes. This unpreparedness can be a reason why teachers may resist taking ownership of ensuring students are engaging successfully with the discipline-specific texts used

in classrooms. Di Domenico et al. (2018) maintain that literacy is at the heart of disciplinary practice, but that “the longstanding resistance to content area literacy instruction could impact teachers’ willingness to incorporate disciplinary literacy practices into their teaching” (p. 81).

Instead of settling for the dichotomy of teaching either content-based literacy or disciplinary literacy, teachers need to be equipped with their own understanding of how they engage with discipline-specific texts. Teachers need to be positioned as experts in their understanding and use of texts. Additionally, educators require the support to understand the literacy practices they use for comprehension (Gilles et al., 2016). As they grow in understanding of their metalinguistic awareness, teachers may have the confidence and discourse to embed their knowledge into their pedagogical practice.

My findings showed that, the participants provided reasons for not teaching disciplinary-literacy practices within classes. Goodall assumed that her science students were learning reading literacy practices from ELA teachers. Elizabeth expected that her high school SS students knew how to read graphs, editorial cartoons, and other visuals. Carmen struggled with the difference between literacy and discipline-specific literacy. Ironically, in her teaching of the necessary ELA literacy practices, she inadvertently taught discipline-specific literacy. Throughout the study, Goodall, Elizabeth, and Carmen became more aware of the importance of purposefully teaching discipline-specific literacy.

On the other hand, Gosset seemed to understand the need to teach math discipline-specific literacy in her class. In the past, she had not understood the importance of teaching math literacy practices. However, before participating in this research, she had already been involved in PL with a math consultant and with math and science teachers working on teaching discipline-

specific literacy skills. Participating in my research confirmed for Gosset the need to add more of these literacy practices to her pedagogical practice.

In the course of my study, Goodall, Elizabeth, Carmen, and Gosset all underwent growth in their understanding of disciplinary literacy and wanted to use this newfound knowledge to improve teaching. The discomfort they felt as they realized they possessed some unknown gaps in their practice fueled the desire to change their teaching practice. The literacy learning experienced by the participants within the context of my study led to empowering and transformative shifts in their understandings of their pedagogical practice.

Goodall's more in-depth understanding of disciplinary literacy obtained during the duration of data collection pushed her to ask a question:

What is it I'm doing at the beginning of the year or even before an exam to which I never paid attention? So now we have encountered a new type of text within a manual [textbook].

I would not stop and say, "So do you notice how this is different from X, from a poem?" I would have never done that.

In frustration, Goodall concluded that "once again the word indictment is far too harsh, but it's, like, why aren't we already doing this [teaching disciplinary literacy]?" She answered her question with, "Because then you get distracted by 21st-century learning and this and this and this, but some things kind of just fall off the wagon, but it really isn't conscious, but it just is." Goodall saw the importance of focusing on disciplinary literacy and not getting distracted by educational trends.

After participating in my research, Elizabeth "definitely" no longer took it for granted that her students had the skills to read the texts before them. She found that realizing her assumptions (about what she expected of her students reading ability) led her to a "deeper

understanding,” and she wanted to help her students read the disciplinary texts more effectively. Elizabeth communicated her appreciation for teaching methods that can be useful to improve her students, and “if this [teaching disciplinary literacy] will help them to read the textbook better, then I’m all for it.” Seeing connections to the competencies that Alberta Education wants teachers to integrate also encouraged Elizabeth’s desire to teach more disciplinary-literacy skills and strategies so that students would read “with a critical eye.” Elizabeth’s intention was that before having students read a text, she was going to get them to skim it and then make some predictions about the content by looking at the pictures and other text features. She is not one for “wrecking a book by highlighting it” and stated that “perhaps I’ll need to photocopy sections for my students” so they would be able to interact with the texts more effectively. As a participant in my study, Elizabeth gleaned a deeper understanding of the importance of teaching disciplinary literacy.

As a result of participating in my research, Carmen wanted to teach disciplinary literacy more effectively in her classroom but was not sure where to begin. She was relieved to have a better understanding of herself as a reader and to discover she had been employing many more skills and strategies than she’d realized she had been using. Carmen needed to think about how to implement it next year. She had some fears about how she was going to implement the teaching more disciplinary literacy in her classes, which she wanted to start in September. She was relieved that she had two months over the summer to get things straight in her head, to meet with her future teaching partner, and to put some thought into how to apply her new knowledge.

Some ideas that Carmen considered for changing her teaching to implement more disciplinary-literacy skills included making some significant changes to use her class time more effectively. She felt her students could do more work, such as notetaking and reading, at home,

so that she could use class time to teach disciplinary-literacy strategies. Carmen thought that for her to sit in class while her students took notes, or for her to read a novel to them, were ineffective uses of her time. She wanted to prompt them to become more active in their reading, and more metalinguistically aware. Regarding her teaching of disciplinary literacy, Carmen stated, “It’s going to change. It just depends on how I structure my classes so that I can spend more time interacting with my kids this way and less time having them copy off the board. Does that make sense? I have some ideas.” Carmen voiced that she was energized to be more purposeful in highlighting discipline-specific literacy in her classes but had not articulated specifics on how to do this. Although Carmen had a desire to add more focused disciplinary-literacy strategies to her teaching, she did not give explicit examples.

Throughout my study, Gosset’s view of disciplinary literacy changed; this impacted her desire to change her teaching practice. It so happened that Gosset had also been influenced by working with a math consultant and two teachers before taking part in this research. Their interactions with reading discipline-specific texts assisted Gosset in her understanding of teaching discipline-specific reading to her students. She understood that being able to read discipline-specific texts is “a skill that [needs to be] taught. Whether it be in-their-face, explicit teaching or whether it be in the background of how we’re talking about a question, it still needs to be addressed.” Additionally, Gosset began to realize that students need to apply reading strategies within the context of math and statistics; students need to be mindful of their thinking.

Gosset had some definite ideas as to what her next steps were going to be to teach discipline-specific literacy within her classes. She wanted to create a list of definitions for reading strategies. She was comfortable with four or five of the strategies but had a desire to teach more. Participation in my research gave her more ideas. She planned on possibly

displaying posters as visuals for her students. She wanted to use the same literacy vocabulary in math and statistics that the students used in other classes. For example, “the summarizing they use in English can be used in my classes. Let’s use those same tools.” She wanted to go in the direction of modelling the use of more of these tools, discussing them, and soliciting more peer evaluations. Gosset was excited to make some changes in her teaching, and said, “it will be fun to experiment with my teaching and know that I have my tools as back-ups.” She further explained that her next steps included assisting her students in improving their metacognition. This increased awareness of thinking—she hoped—would help decrease test anxiety because her students would be attacking the exam questions or problems in the same way they would every day. As a result of participating in my research, Gosset had more confidence, as well as more ideas to help her emphasize disciplinary literacy in her classes.

My teacher participants’ desires to make changes to their pedagogy is commendable. My concern is that because they may not have the support (in terms of time, opportunity, and finances) to make these changes, they will continue teaching with a bit of frustration, knowing what they should be doing but are not able to do. Hopefully, they will receive their administrators’ support to pursue these endeavours. By being given the opportunity to articulate their thinking through think alouds, interviews, and debriefing sessions, my participants gained a deeper understanding of their metalinguistic awareness.

Recommendations for Practice

As evidenced in the last section, the participants in this research had a strong desire to change their teaching practice because of their newfound understanding of their reading engagement and disciplinary literacy. At the completion of this research, they were concerned about how to effectively enact the changes they wanted to make in their classroom practice.

Concerns existed about time, resources, and money. How do they acquire the metalinguistic awareness to be able to converse about it? What can be done to ensure that secondary teachers are allowed to create discipline-specific literacy classrooms? Answers to these questions include changes to three aspects of education: first, changes to teachers' in-service PL; second, changes to pre-service teacher education; and third, changes to decisions made by policy-makers and administrators. The first two sociocultural-based recommendations for practice emphasize the role of social interaction in learning, because the interaction with others acting as the more knowledgeable "other" assists teachers and pre-service teachers (Hui et al, 2021; Jafar et al., 2021; Kadri et al., 2017; Fani & Ghaemi, 2011).

In-Service Teacher Education. Effective in-service teacher education should be provided by people who have a high interest in andragogy (Knowles, 1970; Zepeda et al., 2014; Merriam, 2001; Pew, 2007), a theory of adult learning which Elish-Piper et al. (2016) define as "the art and science of helping adults learn" (p. 13). In his seminal work, Knowles (1970) developed the theory of andragogy, portraying adult learners as being self-motivated, self-directed, ready to learn, experienced, and oriented toward application. Keeping andragogy in mind can help create and implement education for in-service teachers. Once teachers have an established routine and teaching style, it can be challenging to empower them to make their teaching more effective. The transformation of teachers into educators who instruct using discipline-specific literacy may occur if teachers see the need for change and if they have the available time and resources.

Instead of taking student comprehension ability for granted, with needed support, many teachers can acquire the knowledge and skills to help assist students to engage with different aspects of texts more effectively. Taking ownership of their responsibility to teach discipline-

specific texts may be the most important factor in pedagogical change. Because many teachers feel detached and unprepared regarding discipline-specific literacy instruction in their classes, they do not know what they can do; they even can feel helpless. Howell et al. (2021) emphasize that “more PL is needed for teachers enacting literacy strategies specific to their disciplines” (p. 14). I propose that discipline-specific metalinguistic awareness needs to be a central aspect of in-service teacher education. Greater metacognition should assist teachers to provide what Spires et al. (2018) describe as metacognitive scaffolds that make discipline-specific literacy practices explicit to students (p. 1428). Teachers require an understanding of their literacy practice use to model and infuse discipline-specific literacy practices into their instruction. By becoming more aware of their literacy practice use, teachers would be tapping into a readily available unused resource. Teacher metalinguistic awareness would also include their use of content-based literacy (intermediate literacy category) used to employ disciplinary literacy. The importance of disciplinary-literacy instruction needs to start with teachers and their metalinguistic awareness and then move to the literacy practice instruction in classrooms. Teachers need support in discipline metalinguistic awareness beginning at the time they start teaching and continuing throughout their careers. With this newfound cognizance, teachers can acquire more tools to embed disciplinary literacy within their classrooms.

Professional Learning. As teachers continue in their profession it is valuable to continue learning and growing; professional learning (PL) opportunities provide teachers with the education to develop in their teaching craft. PL may be provided at the schoolboard or school level or through further education at post-secondary institutions. Fogarty and Pete (2004, p. 63) proposed five essential characteristics of rigorous PL. It needs to be implemented over time; job-embedded so the training occurs and/or continues at the place of employment; interactive so the

training invites and engages participants; collegial, building and supporting a community of learners; integrated where training is eclectic (web-based, online, text, face to face). I recommend that PL provided to secondary discipline specialists would provide the above recommendations given by Fogarty and Pete (2004).

Secondary in-service teachers are busy planning and implementing instruction in ways that best teach the subject content to students. This busyness can often hinder teachers from improving pedagogy. Suggesting that teachers need to add disciplinary literacy to their already overloaded lives seems overwhelming because many teachers feel they do not have time to learn or the background to teach literacy in classes. Many teachers still do not understand the difference between literacy and discipline-specific literacy, or how to mindfully teach disciplinary literacy (Hinchman & O'Brien, 2019; Cassidy et al., 2020; Brozo et al., 2013). In this regard, I recommend that PL harness the literacy practices teachers already have—that is, their own discipline-specific literacy skills. Secondary discipline specialists are experts in the use and understanding of discipline-specific texts. In the past, discipline-specific literacy PL has been scant and what was available did not focus on teacher thinking. It tended to provide more surface-level application of literacy practices. Byers et al. (2012) emphasize the importance of empowering “classroom teachers with knowledge and understandings of comprehension strategies, and provide them with the tools to successfully implement these in their classroom” (p. 26).

As demonstrated through this research, teachers need support in recognizing their metalinguistic awareness. Most teachers, proficient readers of their discipline-specific texts, would require PL that would move the automaticity of their metalinguistic awareness to purposeful and applicable pedagogical strategies. Having one-to-one instructional support

(Vygotsky, 1978; Jafar et al., 2021; Hui et al., 2021; Warford, 2011; De Beer & Gravett, 2020; Jafar et al., 2021) would assist teachers. First, it would be helpful if teachers had their thinking reflected back at them to bring metalinguistic awareness to the forefront of their minds. Once teachers become metalinguistically aware, they can provide peer support for their colleagues. This type of PL may take more time to implement at first, but the long-term gains for both teachers and students would outweigh the time commitment. This approach would not involve an overwhelming process of revamping pedagogical practice, but rather an addition of explicit modelling of how discipline specialists think, read, write, speak, listen, represent, and view.

In order for a PL provider to assist teachers to have a more insightful metalinguistic awareness, they would need to meet teachers within their zone of proximal teacher development (ZPTD) (Warford, 2011) to draw out their thinking and knowledge. The PL instructor would establish the ZPTD (Warford, 2011) by getting to know the teachers' abilities. In the ZPTD, the PL instructor and the teacher could collaborate (Sturtevant, 2003) on a task that the teacher could not perform independently due to the automaticity of their thinking (Hui et al., 2021). Teachers have strong background knowledge (Warford, 2011; Fani & Ghaemi, 2011), TCK, and pedagogical content knowledge that assists them with their reading engagement; PL instructors should honour this knowledge. Background knowledge and skills give teachers an advantage that allows them to employ self-monitoring skills such as self-scaffolding (Fani & Ghaemi, 2011). When asking teachers to reveal their engagement with texts, it would be helpful to have the teachers choose the texts with which they are going to engage. By choosing the texts, teachers are not only given choice but also demonstrate their reading level. The PL provider will need to develop a relationship with the teachers that allows for a safe space in which teachers can demonstrate thinking, listen to thinking, analyze thinking, and ask specific questions regarding

the participants' metalinguistic awareness. The PL instructor would pose and ask exploratory questions to deepen teachers' metalinguistic awareness. Reflecting the teachers' thinking back to them, using appropriate nonvernacular social language (Gee, 2014), would provide the teachers Discourse and awareness to better communicate reading prowess.

As most secondary teachers lack strong literacy training, they do not have the tools to teach discipline-specific literacy. My research suggests, however, that many secondary teachers do have the tools to understand and teach disciplinary literacy but are not cognizant of these tools that allow for the understanding of discipline-specific texts. When teachers have limited awareness, a PL instructor can provide assistance. As demonstrated through the data collection in this study, secondary teachers do have the necessary tools to talk and model their thinking. Their automatized thinking needs to become conscious (Cleeremans et al., 2020), so students can observe and be taught the literacy practices in action. The use of content-based literacy practices is foundational to disciplinary literacy. A PL provider could assist teachers to recognize the foundational thinking (content-based literacy) used to comprehend discipline-specific texts. Content-based literacy understanding needs to be targeted to meet the needs of discipline-specific text readers.

In a sociocultural manner (Vygotsky, 1978; Warford, 2011; Fani & Ghaemi, 2011; Polly & Byker, 2020), the instructor would work alongside secondary teachers, assisting them to become cognizant of their literacy practice use, give teachers the nonvernacular social language (Gee, 2014) to explain the literacy practices, and assist them in choosing the best discipline-specific literacy practices to teach the discipline-specific curricula. Effective PL would provide one-on-one or pair interaction with these teachers as they look at resources and curriculum. Working in pairs would give teachers a buddy to work with on an ongoing basis. PL providers

could model literacy practices for teachers, either in PL settings or by teaching students. A significant role would be to assist teachers to be more aware of their thinking. The instructor would draw attention to the teacher's metalinguistic awareness by coming alongside and encouraging their thinking by listening, analyzing it, reflecting it, and asking questions. Teachers would be asked to look critically at how they engage with discipline-specific texts. By offering reading engagement Discourse to communicate reading thinking, tools would be provided with which to think and teach. Consistent support of metalinguistic awareness would most likely help secondary teachers improve their discipline-specific pedagogy.

When assisting secondary teachers, one way to make PL more effective would be to let the teachers know what literacy practice they use as soon as possible after identifying it. It is prudent to observe what teachers do without much interference. To help with teachers' growth in the understanding of their metalinguistic awareness, they require clear, distinct support. The use of think alouds would provide teacher's metalinguistic awareness evidence for the PL instructor. It is recommended that the instructor would listen to two or three think alouds (depending on the reader and their ability to think aloud), analyze the think alouds, and then give specific support as the teachers engaged in a few more think alouds. This process would be time-consuming but effective; it would give teachers ownership of the literacy practice Discourse in which they engaged. The teachers could then take their new-found knowledge and adjust their teaching, and in the process, develop a more purposeful disciplinary-literacy pedagogy by creating class routines that include disciplinary literacy. Also, through think aloud and modelling, teachers would demonstrate more effective literacy Discourse to communicate with students.

Effective PL would empower teachers to use the knowledge and abilities they already have to teach discipline-specific literacy skills to students. Having discipline-specific literacy

support available in secondary schools could be an asset in supporting discipline-specific classrooms, but the time and money needed to utilize this support needs to be taken into consideration. Unfortunately, unless administrators have a desire to make discipline-specific literacy a focal point of their schools, the likelihood of time and money being invested is low. One solution would be to have school department heads given PL to give them the tools to support teachers in their schools. The department heads then would share their expertise and collaboratively assist teachers with metalinguistic awareness. Teachers could then work in pairs and support each other as mentors. A teacher peer could assist as a capable peer, buddy, or mediator (Vygotsky, 1978). In the longer term, these pairs could split, and each have a newcomer to mentor. There could be an exponential effect to develop expertise. Potentially, this PL support could help teachers focus on their own reading engagement abilities and then teach and model that discipline-specific literacy thinking in classrooms. Styslinger et al. (2015) point out that by having teachers model for one another, it gives them a context to “live literacy in the safe company of colleagues” (p. 477). As emphasized by Howell et al. (2021), “Collaboration is especially important to help teachers ... integrate disciplinary literacy and overcome the lagging self-efficacy needed to integrate content and pedagogical knowledge” (p. 12).

My research illustrated that when given the opportunity to verbalize their metalinguistic awareness, the participants gained a deeper understanding of how they engaged with texts. Having another person ask teachers specific questions and support their thinking, will encourage teacher metacognition. Through this research, my aim was to learn about how secondary discipline specialists engaged with discipline-specific texts and to glean as much information from the participants as possible. Many scholars (Spires et al, 2018; Howell et al., 2021; McArthur, 2012; Moje, 2015; Fang, 2014) recognize the need for effective instruction of

disciplinary literacy. Effective PL that focusses on teacher metalinguistic awareness could not only give teachers the opportunity to develop their thinking, but also give them more tools to improve their pedagogy.

Teachers must be given and must take ownership of discipline-specific literacy in classes (Malmström & Pecorari, 2021). Most secondary teachers are successful in their understanding of and ability to read discipline-specific texts. There is excellent value in harnessing their discipline-specific text engagement abilities. Allowing these teachers to become more metalinguistically aware of their disciplinary literacy assists them in assuming discipline-specific literacy ownership. The change can start by providing the appropriate Discourse to communicate the teachers' thinking. The disciplinary-literacy tools they expect students to use as they read needs to become a consistent part of teacher and classroom routines. I concur with Wolsey and Lapp (2017) in that if PL providers and secondary teachers look at PL as a partnership that can collaboratively “explore the disciplines, much can be learned, and much can be translated into action in the classroom” (p. 216). Gilles et al. (2016) highlight a promising schoolwide pedagogical practice of incorporating “reading processes and strategies by using similar language and then discussing what each means in particular disciplines” (p. 682). Teacher can be supported to recognize and identify their discipline-specific literacy practices as well as assist in developing discipline-specific lesson plans that purposefully teach discipline-specific literacy practices.

Pre-Service Teacher Education. An effective way to assist teachers to include discipline-specific literacy instruction in their classrooms is having it taught and modeled at universities (Mpofu & Maphalala, 2020; Scott et al., 2018; Feez & Quinn, 2017). Modelling is a form of scaffolding (Bruner, 1975, 1978) an aspect of sociocultural theory (Vygotsky, 1978,

2012). Concurring with Boyle et al. (2013), even after receiving an education degree, teachers often return to teaching the way they were taught; therefore, a change in pre-service pedagogical thinking is significant. Seeing that pre-service teachers are adults it is important that the theory of andragogy (Knowles, 1970; Elish-Piper et al., 2016) be considered in their education. Having the importance of discipline-literacy modelled and taught in university classes is important to better equip future teachers. More importantly, their attitude toward and ownership of disciplinary literacy (Malmström & Pecorari, 2021) might become more positive.

There is a great need for teachers to be able to apply discipline-specific literacy in classrooms. Mitton Kukner and Murry Orr (2015) explain that “pre-service teachers require a strong foundation in this area [disciplinary literacy] as they prepare to teach students in schools throughout Canada and beyond” (p. 4). Researchers such as Mitton Kukner and Murray Orr (2015) and Lesley (2014) concur that little agreement exists regarding the most effective ways for training pre-service content area teachers to implement literacy as a component of their instructional toolbox, and teacher instructors are confronted with numerous possibilities as they create courses. Marlatt (2018) explains, “Building instruction from a foundation of disciplinary practices helped preservice teachers reframe their backgrounds in a constructive manner” (p. 11). Shanahan and Shanahan (2008) point out that “a literacy curriculum that directly guides students to better meet the particular demands of reading and writing in the disciplines” (p. 57) would be more effective than what is “provided by traditional conceptions of content-area literacy” (p. 57).

Up to this point, content-based literacy skills courses are quite popular at many universities, but many of these courses do not teach discipline-specific literacy. For example, at the University of Alberta (2020), the course EDSE 307: Language, Literacy, and Society in Educational Context, is “designed to prepare teachers to develop English language and literacy

abilities in learners in Grades 7 through 12, particularly diverse and minority learners.” The King’s University’s (in Alberta) EDUC 409: Cross Curricular Literacy curriculum addresses some of these issues, including teaching generic literacy strategies. The course was designed to acquaint secondary pre-service teachers with the varied literacy needs of adolescent learners. Course content emphasized learning teaching strategies that help students understand subject specialized expository texts. Having required courses such as EDSE 307 and EDUC 409 is commendable, in that they assist pre-service teachers in meeting the learning needs of future adolescent students. However, depth and understanding of discipline-specific literacy seems to be missing in these types of courses (McArthur, 2012). When referring to pre-service teacher content-based literacy courses, McArthur (2012) emphasizes that “what is needed is more understanding about disciplinary literacy and how preservice content area teachers might use those literacy practices with their less experienced adolescent students” (p. 51). The Pre-service teachers need to understand how they engage with discipline-specific texts so that that understanding can be taught and modelled to future students. Modelling is a form of scaffolding (Bruner, 1975, 1978), an aspect of sociocultural theory (Vygotsky, 1978, 2012).

Universities need to more effectively support pre-service teachers in being prepared to teach discipline-specific literacy. Fang (2014) explains, “An emphasis on disciplinary literacy presents new challenges for teacher education because it requires a deep understanding of both disciplinary content and disciplinary habits of mind” (p. 444). Most secondary pre-service teachers have a major and a minor, both of which they hope to teach. This education within specific disciplines provides stronger background knowledge that gives them deeper understandings of the subjects they could be teaching in the future. Because pre-service teachers have a stronger background in these majors and minors, they should successfully engage with

discipline-specific texts. Marlatt (2018) explains, “Building instruction from a foundation of disciplinary practices helped preservice teachers reframe their backgrounds in a constructive manner” (p. 11). Even with their background knowledge, pre-service teachers need the ability to articulate how they engage with discipline-specific texts. Fang (2012b) points out that “it is through participation in discipline-specific practices of reading, writing, talking, inquiring, thinking, and reasoning that disciplinary knowledge and disciplinary habits of mind are used, shared, critiqued, refined, and expanded” (p. 33).

Effective teachers must have discipline-specific literacy practices in their teaching toolbox to effectively teach disciplinary literacy. Teaching strategies taught in university courses, such as those mentioned above, should be made discipline-specific, so it is important to give strategies with discipline-specific examples. Additionally, it is important to emphasize pre-service teachers’ discipline-specific literacy practice metacognition. Based on my research, I recommend four goals or points that would help in teaching discipline-specific literacy in required secondary literacy-type courses; these points will also help in the ownership to teach discipline-specific texts.

The first point is to assist pre-service teachers to grow in metalinguistic awareness, in understanding what they do as they engage with discipline-specific texts. As with the participants in this research, if pre-service teachers become more cognizant of their metalinguistic awareness, this should assist them in articulating metacognition to future students. If pre-service teachers are more aware of how they engage with the texts they read, they can model more literacy practices to explain to students how to make the implicit, explicit. The second point is to give pre-service teachers the pedagogical strategies to be able to teach literacy practices in their disciplines. These strategies include being aware of how discipline specialists view and interact with their subject

matter—both the foundational content-based literacy and as well as disciplinary literacy (McArthur (2012). Discipline-specific literacy strategies should be provided. The third point is to assist pre-service teachers in their ability to think aloud and model, which are two crucial teaching skills. Finally, and what may be the most valuable point, pre-service teachers should start thinking about and implementing the creation of classroom environments that encompass and exemplify discipline-specific literacy. Pre-service teachers need to create lesson plans that emphasize disciplinary literacy. These goals fit into Love's (2009, p. 541) three components of literacy pedagogical content knowledge (LPCK), which are the knowledge of how spoken and written language can be best structured for effective learning. The recognition is that subject areas have their characteristic language forms and hence entail distinctive literacy practices. Love's (2009) last component is the capacity to design learning and teaching strategies that account for subject-specific literacies and language practices (p. 541).

Pre-service teachers require a knowledge of various literacy practices, including reading strategies with discipline-specific applications. It would be helpful for pre-service teachers to be aware of how they think as they engage with discipline-specific texts. Mpofo and Maphalala (2020) explain that there is a justification for specific discourses for each discipline. These discourses connect to the “Vygotskian view that emphasises sociocultural cognitive development, that is, providing student teachers with opportunities to develop an awareness of specific discourses that induct them into the world of being in their discipline” (pp. 3-4). As demonstrated in my research, the participants were unaware of all the literacy practices they used because of the automaticity of their thinking. There was a need for reading engagement nonvernacular social language (Gee, 2014) to help in the explanation of their metacognition. I infer that because many in-service teachers had these issues with metalinguistic awareness, many

pre-service teachers would have similar issues. Giving pre-service teachers opportunities to become more aware of their thinking as they engage with discipline-specific texts, would better equip them to teach discipline-specific thinking to future students.

Fang (2014) suggests that pre-service teachers enroll in discipline-specific cohorts. These cohorts could be helpful because pre-service teachers would be surrounded, and would consistently experiencing reading, writing, speaking, listening, viewing, and representing of a specific discipline. On the other hand, having students from all disciplines within a class of pre-service teachers would give opportunities to explore discipline-specific literacy from the perspective of different disciplines. Pre-service teachers could see the differences and the importance of the varying thinking and literacy practice needs required to teach and learn different disciplines. By observing and discussing discipline-literacy with pre-service teachers from other disciplines, they would see both the differences and the similarities of engaging with discipline-specific texts. It would help them realize the importance of teaching discipline-specific literacy practices.

One of the issues of having a literacy teacher educator (LTE) teaching a discipline-specific literacy course is that an LTE is not an expert in every discipline (Fang, 2014). One person cannot be an expert in all disciplines. The one solution to the problem of LTEs not being all-disciplines experts is to empower discipline specialist students in the university classroom. An LTE would encourage this expertise in a coaching role. In taking on this role, an LTE would assist each pre-service teacher to build understanding as to what they do as discipline-specialists engaging with discipline-specific texts. By doing that, an LTE would be teaching in the pre-service teacher's ZPTD (Warford, 2011; Fani & Ghaemi, 2011; Kadri et al., 2017; Hui et al., 2020; Jafar et al., 2021; De Beer & Gravett, 2020), accessing their knowledge. By giving

students the place to be metalinguistically aware of how they think as they engage with their discipline's texts, they should be able to voice their thinking.

By taking courses that explore each pre-service teacher's metalinguistic awareness of discipline-specific texts, most pre-service teachers should be better equipped to teach literacy practices to practicum class students. Discipline-specific literacy needs to be embedded within classroom routines. Before going on to student teaching and then to teaching as a profession, pre-service teachers should be equipped with effective discipline-specific literacy practices that give them the best background to begin the journey of becoming the most effective discipline-specific teachers they can be.

The sooner teachers have the opportunity and support to understand discipline-specific thinking when it comes to reading engagement, the more teaching tools they will have in their teaching toolbox. As established by my research, it takes time, practice, and feedback for teachers to be cognizant of their text metalinguistic awareness. Pre-service education and experience are needed, as well as ongoing PL for in-service teachers.

To extend teaching discipline-specific literacy, why is discipline-specific literacy not being taught in the curriculum and instruction courses that pre-service students need to take? Boyle et al. (2013) recommend that disciplinary literacy be taught in science, technology, engineering, and mathematics (STEM) curriculum and instruction courses. Scott et al. (2018) emphasize that "integrating literacy into discipline-specific methods classes can provide preservice teachers with instructional strategies better suited for the content curriculum and the academic language—the fundamental argument of disciplinary literacy" (p. 9). A disciplinary-literacy focus needs to be a part of all other curriculum and instruction courses as well. Including discipline-specific literacy would mean that subject-specific curriculum instructors would

receive more training and metalinguistic awareness work. Marlatt (2018) points out, “By approaching literacy instruction as the things we do in our disciplines, teacher educators can perhaps better prepare candidates across content areas to meet the present challenges of literacy integration” (p. 2).

If universities recognize the need for more discipline-specific literacy instruction, pre-service teachers can be educated in their strategy uses. This newfound discipline-specific literacy knowledge can then be added to classroom routines to be developed throughout their careers. It is somewhat more difficult for practicing teachers to adjust their pedagogy so as to purposefully add discipline-literacy literacy practices; to change the thinking of in-service teachers takes time and access to disciplinary-literacy support. Often, it is policy-makers and administrators who determine how much time and access teachers have to access literacy support and to be involved with PL.

Policy-Makers and Administrators. In education and teacher practice, yearly trends may develop so that in-service teachers are required to conform with the choices of their school boards and principals. Instead of focusing on specific teaching practices for a reasonable amount of time, these teachers often find that the focus of the school can switch every year.

Consequently, teachers may become overstretched regarding time constraints and often feel that they have not yet become competent in one area before they must shift attention to another.

A need exists to focus on developing the teaching of discipline-specific literacy within classrooms; however, it will require time, money, thoughtfulness, and support. It will also take time to develop purposeful thinking and teaching practices. While teachers may have the desire and drive to modify their teaching practices, it will be challenging to make the desirable changes if time and funding are not available to support the growth and learning of instructors.

The participants in this study, for example, were concerned about how to implement their new-found understanding of reading engagement because of time and money constraints related to their professional lives. As Fine et al. (2011) note, administrators and policy-makers hold power concerning where to devote time and money. In this context, if a principal does not support a discipline-specific literacy focus within a school, teachers may not feel supported to change their pedagogy. Policy-makers and administrators may not know the importance of disciplinary literacy because they may take it for granted that teachers know how to teach discipline-specific literacy. Perhaps policy-makers and administrators are not aware of the literacy practices they use to engage with the various texts they read. If these important people in the organization of school boards, schools, and staffing understood the significance of emphasizing discipline-literacy in schools, they might change their minds about how to designate time and money in support of discipline-specific literacy.

Policy-makers can ensure that curriculum contains courses that focus on the need to develop discipline-specific literacy instruction. For example, within the Alberta context, the Program of Studies—the Alberta curriculum—would need to ensure that discipline-specific literacy is stressed. Curricular knowledge would need to be well grounded in the literacy within the discipline. Spires et al. (2018) confirm there is a need for “adoption of literacy standards in ELA, science, and history and social studies” (p. 1428) as well as math in curriculum. Teacher resources and PL also would need to have a disciplinary-literacy focus. The curriculum should also incorporate the applicability of career options and the literacy practices required within each career. For example, a statistician thinks a certain way, so a statistics teacher needs to model and expose students to that way of thinking. A journalist needs to look at the facts of a story and then write an unbiased column to inform the reader. Importantly, for teachers to provide a strong

curriculum-driven discipline-specific education, they would need to be supported with resources and time to develop their understanding of the discipline-specific-centred curriculum. By supporting teachers, policy-makers can positively affect the learning and success of our next generation.

School district administrators, including superintendents and principals, can determine the focus of the schools and the allocation of time and money. Most teachers want to create the best classroom milieus to ensure students glean the best education possible. Administrators have the responsibility to develop timetables that most effectively build the learning environments in which teachers teach and students learn. The teacher participants who took part in this research were successful in reading because they had the interest, education, background, teaching experience, and literacy practices that enabled them to understand the texts read. This passion and background give them insights into the discipline-specific or subject-specific curriculums they teach. From this research, teachers must teach subjects that are their strength and passion. For example, because Elizabeth made so many connections as she read, it shows how strong her history background is. Someone without that background would not have had access to as much content. This solidifies the importance of teachers having strong teacher content knowledge for the courses they teach (Spires, et al., 2018). Teachers can take their knowledge and passion and share it with their students. Administrators need to consider this as they staff schools and give assignments to teachers. That is easier said than done because of budget and timetabling constraints.

Reflection

“Knowledge itself,” explain Maddux and Donnett (2015) “is productive: it results in behaviors and beliefs that have observable consequences on our own lives and on the mental as

well as social lives of others” (p. 64). Maddux and Donnett’s explanation of the aspects of pragmatism, including that knowledge drives our actions, resembles my own pragmatic fashion of reflection as a teacher and researcher. For example, I complete a task, reflect, make any necessary changes to my practice, and go forward. My reflection produces observable consequences in my qualitative research, teaching practice, and in the people my practice influences (Ely et al., 1997). This final piece of writing reflects my learning throughout the process of researching and writing my dissertation, as well as the consequences my work has, and will continue to have, in my life, the teaching community, and scholarship.

The journey towards my EdD involved significant growth in my thinking as an academic researcher rather than as a teacher-researcher through positive and enlightening experiences but also through some periods of discomfort. Maddux and Donnett (2015) point out that “the exercise of reflective thought requires that educators create a situation of discomfort for learners, and mandates that students examine the warrants of settled belief (i.e., assumptions)” (p. 62). Like many novice qualitative researchers, I experienced what Ely et al. (1997) call disequilibrium (p. 333). The discomfort or disequilibrium, I experienced in learning how to think differently, to study the varied perspectives on my topic, and to put my research plan into action pushed me to shift from the teacher to the academic. I also learned that some of the discomforts I experienced might be connected to assumptions I held from previous experiences.

This dissertation required much more extensive research than I am accustomed to, such as what was required when I earned my course-based MEd degree or in my current secondary education teaching. As a teacher, I continually conduct research to better assist my students with their learning; however, I quickly discovered that doctoral level research is very different. Maybe my biggest lesson through this EdD process was how clear I need to be in how I explain my

plans, thinking, and observations. It was, at times, difficult to know what needed to be explained with more or less detail. In writing, audience can help predict the level of detail or information required; however, by not being familiar with the audience, I wondered how to know what to include in an already large document. For example, when explaining the data collection, I did not know how much detail of the process needed to be included. With guidance, I was able to include more detail with examples to create a fuller picture. Another example was when I was writing and explaining specific transactional theory applications. With support and examples from my committee, I learned the benefits of more thoroughly describing Rosenblatt's views on this theory and how to support my findings with a detailed application of her work and other connected literature and studies on transactional theory.

When I began this research, I had many questions regarding disciplinary literacy, secondary discipline specialist teachers, metalinguistic awareness, and the implementation of teaching disciplinary literacy. My desire to get more insight into these areas, increased the scope of my research. Having to manage, analyze, and interpret all the data accumulated caused me to expand my thinking. Exploring both seminal and the newest literature and research gave me a broader understanding of the research topics.

Suggestions for Further Research

As I close this dissertation, I am left with several possible further research ideas. The first idea is that if a similar case study were to be embarked upon, after two think alouds, more specific feedback should be provided to the participants, who would then be able to use literacy practice nonvernacular social language (Gee, 2014) such as inferring, predicting, analyzing, evaluating, and making connections (t-t, t-s, t-w, t-within-t) to label their thinking in subsequent think alouds. Doing this would give the participants practice in using the Discourse in classes.

Second, a more extensive study could be conducted, using 10 or more of each discipline specialist, to analyze their metalinguistic awareness, looking more closely at the similarities and differences between their thinking. Third, using participatory research design, a researcher would get full input from secondary teachers on what they need in order to teach disciplinary literacy. Fourth, further research could include how secondary teachers engage with multimodal literacy and New Literacies specifically. Serafini (2014) states, “In the twenty-first century, anyone who cannot handle multimodality is illiterate (p. xi).” With COVID-19 and the prevalence of on-line learning, the use and understanding of multi-modal literacy and New Literacies has become significant. Fifth, a study on how policy-makers and administrators view discipline-specific literacy may shed light on how to ensure school organization and staffing help in the development of discipline-specific-rich classrooms. Sixth, because the demographics indicate student populations are becoming more diverse, there is a greater need to investigate secondary discipline teachers’ experiences of teaching literacy practices to culturally and linguistically diverse students. Finally, interestingly, when I was recruiting participants for my research, no male volunteers responded. Further research could inquire into gender-specific participation in disciplinary literacy research. Was the lack of male interest in the project due to the research questions, the data collection, or for other reasons?

Conclusion

I began this study hoping to better understand how to assist secondary discipline specialists to take ownership of disciplinary literacy. When I started this research, the literature suggested that many secondary discipline specialists were resistant to teaching literacy practices that would assist students in comprehending texts successfully (Smagorinsky, 2015; Cantrell et al., 2009; Malmström & Pecorari, 2021). In trying to alleviate teachers’ hesitation, there has been

a push for discipline-specialists to teach generic reading strategies or content-based literacy without taking into consideration each discipline's specific culture, perspective, and literacy practices. Looking at discipline-specific literacy from a different perspective allows teachers to be more purposeful in instruction.

Through this journey of secondary discipline-specific literacy awareness, I have gained invaluable experience and understanding about how secondary discipline specialists engage with discipline-specific texts. I must commend my participants for providing such rich and enlightening contributions. They used numerous literacy practices to comprehend the texts. The background knowledge of these teachers was a necessary tool in helping them understand what they read. All four of the participants loved their subjects and found passion in difficult texts. This passion, along with their perseverance and resilience, helped them complete such challenging texts. They read as discipline specialists are expected to read (Lent, 2016; Shanahan & Shanahan, 2008, 2012; Shepherd & van de Sande, 2014). Most secondary discipline specialists have the discipline-specific literacy practices needed to engage successfully with discipline-specific texts. If they become more cognizant of what they do, and are able to have the appropriate Discourse to discuss their reading prowess, they will be better able to teach discipline-specific reading to students.

Elizabeth, the SS teacher participant, labelled the need to teach disciplinary literacy a "permeation of literacy." Building discipline-specific literacy-rich classrooms would be "a permeation of literacy." It is accomplishable. Most secondary discipline specialists can engage successfully with discipline-specific texts. My research offers a few solutions that would make it easier for secondary teachers to model and teach the discipline-specific literacy practices that will develop students into discipline-specific thinkers. According to Moje (2015):

If ... teachers, school leaders, policymakers, and researchers conceive of literacy teaching and learning as being about teaching young people the purposeful and meaningful literacy practices engaged by people within and across disciplinary domains, then teachers can embed literacy teaching practice in meaningful ways. Rather than expecting youth to arrive in the classroom with the preexisting motivation to learn a discipline, teachers can apprentice and guide students into their own understanding of the value and purpose of the disciplinary reading, writing, speaking. (p. 255)

Through this inquiry, I am better equipped to assist pre-service teachers take ownership of disciplinary literacy by encouraging them to explore various aspects of building a discipline-specific-rich future classroom. I also enhanced the tools that allow me to assist secondary discipline specialists become more metalinguistically aware and understand how to purposefully add literacy practices into classrooms. Fang (2012b) points out “Developing disciplinary literacy involves extending students’ meaning potential through language ... students need to expand the repertoire of language skills ... learning to recognize how language is used in different disciplines to present knowledge, give value, and create specialized texts (p. 33). If teacher specialists are mindful of their metalinguistic awareness while reading discipline-specific texts, it might be easier for them to embed this cognition into their teaching practice of instructing students how to engage texts as discipline specialists.

The intricacy of disciplinary literacy became clearer as the themes emerged through my data analysis and I discovered that in other current research (Shepherd & van de Sande, 2014; Spires et al., 2018; Lee et al., 2021; Paugh & Wendell, 2021; Howell et al., 2021) no consistent distinct separation exists between content-based literacy and disciplinary literacy. Minh-ha’s (1989) quote, “despite all our desperate, eternal attempts to separate, contain and mend,

categories always leak” (p. 94), fits with my observation of this lack of separation. As I have stated throughout this document, reading is very complex. Howell et al. (2021) emphasize that “Even though disciplinary-literacy builds upon the skills of content area literacy, success with the latter does not guarantee the former” (p. 3). Reviewing the data and themes in my study numerous times allowed me to see a strong link between content-based literacy and disciplinary literacy, in that an understanding of content-based literacy is necessary to comprehend discipline-specific texts and that the relationship between them is very complex.

My research has provided some suggestions to educators, administrators, policy-makers, and universities regarding making discipline-specific literacy more accessible to secondary pre-service teachers, in-service teachers, and students. I agree with Hinchman and O’Brien (2019), who point out, “If the field [disciplinary-literacy research, practice, and policy-making] continues to choose the road to hybridity in disciplinary literacy—the road that shows respect for students’, subject-area teachers’, and disciplinary ways of knowing—the long-term prospect for disciplinary-literacy research, practice, and policy is promising” (p. 532). Changing the discipline-specific literacy ownership perspective of secondary discipline specialists is not an impossible task. Doing so would greatly benefit the end goal of preparing students for post-secondary education and professions in the disciplines. With the necessary support, secondary teachers could start students on a lifelong journey of exploring how various discipline specialists read and—more importantly—think.

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Appendix A:

Characteristics Needed by Discipline-Specific Readers

Science	Mathematics
<p>Lent (2016, p. 17)</p> <ul style="list-style-type: none"> • Assume an objective stance • Search for answers to relevant questions • Sift through and evaluate quality and quantity evidence • Look for data-based outcomes • Determine validity of source • Decipher vocabulary necessary for conceptual understanding • Question reasoning and conclusions • Pay attention to detail and numbers • Collaborate with colleagues when faced with complex ideas • Chart, illustrate, and graph data and conclusions • Consider alternatives to what has been presented • Ask “Why?” more than “What?” • Understand that theories are subject to change and seek out more current findings <p>Shanahan and Shanahan (2008/2012)</p> <ul style="list-style-type: none"> • Focus on the texts themselves rather than on the authors • Evaluate and particularly test investigational and observational proof and reason (2012) • Draw conclusions from texts to reproduce final products in similar circumstances, using similar variables (2008, 2012) • Visualize writing down formulas – chemists (2008) • Compare and contrast information from diagrams, graphs, charts - chemists (2008) • Build upon concepts – chemists (2008) • Concentrate on information that was not a part of their knowledge as well as information that interrupted their expectations – physicists (2008) 	<p>Lent (2016, p. 18)</p> <ul style="list-style-type: none"> • Use the information they are reading as pieces of a puzzle to be solved • Make meaning out of mathematical symbols and abstract ideas • Act as investigators looking for patterns and relationships • Seek to understand what the problem is asking them to do rather than reading only for information • Ask questions as they read • Make notes of misconceptions or confusion • Read for accuracy and clear mathematical reasoning • Scrutinize ways that math is reported in the media or in real-world applications • Apply previously learned mathematical concepts • Look for what is missing • Think about how vocabulary may be used differently in math contexts <p>Shanahan and Shanahan (2012)</p> <ul style="list-style-type: none"> • Thinking about authors does not help focus on and understand the text • Understand their texts by concentrating on the effects of a set of axioms or self-evident truths (2012) • Concentrate on the effects of a set of axioms or self-evident truths (2012) • reread to ensure understanding “the precision of meaning, and each word must be understood specifically (p. 49). <p>Shepherd and van de Sande (2014, p. 77)</p> <ul style="list-style-type: none"> • Use mathematical fluency <ul style="list-style-type: none"> ▪ Translate and articulate words and symbols ▪ Skim • Employ comprehension monitoring <ul style="list-style-type: none"> ▪ Aware of self-monitoring ▪ Activate comprehension checks ▪ Require perseverance and willingness to repair lack of comprehension • Use engagement <ul style="list-style-type: none"> ▪ Search beyond the actual passage to more fully understand the material

Social Studies	English Language Arts
<p>Lent (2016, p. 19):</p> <ul style="list-style-type: none"> • Compare and contrast events, accounts, documents, and visuals such as infographics or photographs • Interpret primary and secondary sources with an eye toward bias • Create narratives from existing information • Use knowledge of the present to make sense of the past and vice versa • Situate new understandings within background knowledge • Think sequentially to piece together timelines • Make inferences and ascertain what is important from what is merely interesting • Untangle threads of fact from often conflicting accounts and perspectives • Determine meanings of words within context <p>Shanahan and Shanahan (2012)</p> <ul style="list-style-type: none"> • Cognizant of writers’ sources and biases and “the implications of the author during interpretation” (2012, p. 11) • Examine primary and secondary documents and sources, to study historical events • Collect information from partial texts after an event has occurred • Draw conclusions that plausible, but not precise • decipher what story the author wants to tell (2008) • Read, knowing they are getting an interpretation of history and not “Truth” (2008, p. 50). • Aware of two biases—those of the text’s author(s) and their own (2008) • Infer cause-and-effect when studying events and what precedes and follows them (2008, p. 56) 	<p>Lent (2016, p. 20):</p> <ul style="list-style-type: none"> • Look for ways that characters, setting, and conflict may influence the meaning of the text • Understand the use and effect of figurative language • Find underlying messages that evolve as a theme • Read skeptically, discerning unreliable narrators or characters • Recognize devices authors use to enhance their writing, such as flashbacks, hyperbole, or analogy • Read nonfiction critically, looking for biases or fallacies in reasoning • Summarize and synthesize ideas in non-fiction and events in fiction • Use reading to make connections or understand real-world issues • Understand how voice works to construct meaning • Use text structure as a tool for comprehension • Pay attention to new vocabulary or to how words are used in unusual ways • Engage in a mental dialogue with the author <p>Shanahan and Shanahan (2012)</p> <ul style="list-style-type: none"> • Interpret the author along with the text and, at times, focus on the words of the literature with no consideration of the author at all (p. 11) • Explore fictional or imaginal representations of human relations or development (p.12)

Appendix B:

Teacher Information Letter and Consent Form

STUDY TITLE: *Exploring Secondary Discipline-Specialist Teachers' Engagement with Discipline-Specific Texts*

Research Investigator

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Doctoral Supervisor

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 Office: (780) 492-2016
wiltse@ualberta.ca

Date: _____

Dear Gosset:

I am a doctoral student conducting this study as a part of my EdD requirements. I have been teaching for 22 years and am very interested in assisting adolescents to become the best comprehenders of text as possible. It seems to me that if secondary discipline-teacher specialists are aware of how they think when they read discipline-specific texts, they are more likely to communicate to their students how to think as discipline specialists. The disciplines referred to in this study are math, science (biology, physics, or chemistry), English language arts (ELA), and social studies (SS).

I am writing to invite you to participate in a study entitled “Exploring Secondary Content-Specialist Teachers’ Engagement with Subject-Specific Texts.” As a secondary math specialist interested in the instruction of content specific texts and assisting students to successfully navigate through these texts you may be interested in participating in this study.

The research has the following purposes:

- **to seek an understanding of how secondary discipline-specialist teachers engage with their content-specific texts**, for math, science (biology, physics, or chemistry), ELA, and SS teachers each use similar/different skills, strategies, and practices as they read.
- **to explore the metacognitive strategies or thinking processes secondary discipline-specialist teachers use when engaging with their content-specific texts** for if these teachers are metacognitively aware of their discipline-specific reading they are more likely able to teach their students how to read as a subject specialist.

- **to investigate what discipline-specialist teachers recommend as supports** to their communication of discipline-specific reading thinking processes.
- **To examine how discipline-specialist believe that they can support** students to think as discipline specialists as they read discipline-specific texts.

The study will involve your participation in at least two one-two hour audio-recorded interviews; the observation of your teaching in your classroom (one class); the audio-recording of your think alouds and think quietly (writing your thinking down as you read) of at least four self-chosen three to five page content specific texts (occur over at least two one-two hour sessions); the collection of at least four lessons plans gathered throughout the data collection; and the collection of your reflection journal which will be collected throughout data collection. The research will take place in your classroom(s), on mutually agreed-upon dates between May 1, 2017 and June 30, 2017.

If you agree to participate, I will observe you teach in your class to gather an understanding of the environment in which you teach. I may take photos of your classroom without students present. Throughout the length of the study, I will ask you to share the following: some demographic information, your reading and teaching histories, understandings of literacy and discipline-specific literacy, texts that you find useful for understanding of your subject, texts that you use to inform your pedagogical content knowledge, and your experiences in reading and teaching discipline-specific texts. You will be asked to share a reflection journal and at least four lesson plans throughout data collection.

One audio-recorded interview will occur at the beginning of the data collection. Prior to this interview, you will be given some pre-interview activities (PIA's). During the interview, you will be asked questions related to your general literacy understanding and then more specific questions related to discipline-specific literacy. You will then participate in the reading of at least four self-chosen discipline-specific texts using either think aloud or think quietly. The last audio-recorded interview will occur after your readings and will follow-up your understandings about discipline-specific literacy.

If you consent to participate in this study, you will be given a pseudonym and neither your real name nor the name of your school will be used in any written or oral presentation of data. Only myself and my doctoral supervisor will have access to the data collected. I will transcribe the audio-recordings, and you will be given the opportunity to read and comment on all transcripts of the data.

Your participation in this research is entirely voluntary and you may decide to withdraw at any time during the study until August 31st, 2017, by which time data will have been analyzed. If you decide to withdraw, your data gathered to date will be destroyed. The data will be stored in a secure locked container in the Education Building, or in my home for the duration of the study and for five years thereafter. Digital data will be kept on encrypted computer files. At the end of the five years, all data will be destroyed to ensure privacy and confidentiality. I anticipate that this study will offer you a valuable opportunity for professional development.

Data from this study will be shared through a dissertation and possibly through professional articles and in-services.

The plan for this study has been reviewed for its adherence to ethical guidelines by a Research Ethics Board at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Research Ethics Office at (780) 492-2615.

If you agree to participate, please sign the attached consent form and return it to me in a week's time. Thank you very much for your cooperation. For further information, please contact us at the following email addresses or phone numbers:

Sincerely,

Marylou Dickson EdD Candidate: [mrdickso@ualberta.ca](mailto:mr dickso@ualberta.ca) (780-986-8201)

Dr. Lynne Wiltse: wiltse@ualberta.ca (780-492-2016)

I, _____, hereby consent to be involved in the research project
(name of volunteer)

entitled “*Exploring Secondary Discipline-Specialist Teachers’ Engagement with Discipline-Specific Texts*” being conducted by Marylou Dickson.

I agree to be involved in this research project by:

- being observed in my classroom;
- participating in at least two audio-recorded interviews;
- participating in think aloud or think quietly while reading discipline-specific texts;
- writing or recording a self-reflection journal and sharing that journal;
- allowing photos of my classroom without students present;
- providing at least four lesson plans throughout data collection.

I understand that:

- I may withdraw at any time until August 31st, 2017, by which time the data will be analyzed;
- a pseudonym will be used to protect my identity and the identity of my school in all representations of the research;
- all information gathered will be treated confidentially and discussed only among the Marylou Dickson and her supervisor Lynne Wiltse;
- any information that identifies me or the institution I am associated with will be destroyed upon completion of this research;
- any audio-taped interviews will be transcribed.

I understand that the results of this research will be used only in a doctoral dissertation, presentations, and written articles for other educators.

Name: _____ Signature: _____
(please print)

Date signed: _____ Phone: _____ E-mail: _____

For further information, please contact:

Marylou Dickson EdD Candidate
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If you have any questions or concerns about your rights as a participant or how this study is being conducted, you may contact the Research Ethics Office at 780-492-2615.

Appendix C:

Possible Pre-interview Activities

Please use colored markers and pens and a blank sheet of paper to complete one or two of the following **Pre-interview Activities (PIAs)**. Please bring the completed activity to our interview. We will begin the interview by having you chat about what you made. Some of the PIAs are “getting to know you” or “know you better” activities and some pertain to the research topic.

1. Draw a diagram to show from where your collegial support or support systems come.
2. Show a schedule for a typical teaching week and use colors to indicate how your time is spent.
3. Draw two pictures showing what things were like for you before and after something important happened in your teaching life.
4. Draw a picture of an important place in your teaching career and use key words to indicate the parts or what happens in each of the parts.
5. Bring an artifact that speaks to your disciplinary-literacy teaching experience and then use it to speak about your view of yourself as a discipline expert.
6. Draw a diagram showing the sources of your ideas, encouragement, and convictions about ways to support students' literacy.
7. Make a sequential set of pictures (cartoon strip) showing the before and after situation in which a student finally got a disciplinary-literacy concept you were teaching. Use speech bubbles or thought bubbles.
8. Try to recall how you have changed any of your main ideas or practices about supporting students' disciplinary literacy. Make a timeline indicating key changes or key events that contributed to the changes.
9. Make two pictures showing what things were like for you before and after any major changes in your awareness about supporting students' literacy development. Use speech bubbles or thought bubbles.
10. Make a list of 20 important words that come to mind for you when you think about student disciplinary literacy, and then divide the list of words into two groups.
11. Draw a picture representing your understanding of how you engage in one of your content specific texts. Use speech bubbles or thought bubbles.

Appendix D:
Interview Questions

Get to Know You

1. Is there anyone you see as a kind of hero or heroine or mentor as a teacher; someone you look up to and always wanted to be like? Who is a mathematician for whom you have high esteem? Why?
2. As a teacher, what would you like to be really good at doing? Why?
3. If you could spend two weeks with someone who does a special kind of educational work, what kind of person would that be? Why?
4. In the year, ahead, what are some of the things you'd like to accomplish or try for the first time?
5. In all your teaching interests or ideas, you have thought about, what has puzzled you the most?
6. If you would have chosen another career, what would you have done? Why?

Professional Pathway

7. Besides being a teacher, do you have an affinity to any particular group(s) within your school or the profession as a whole? Please describe these groups and why you feel this affinity.
8. How long have you been a Math teacher? A teacher of any kind?
9. Can you describe any favorite or most enjoyable teaching jobs you have had and why this was?
10. What are some of the things that make your teaching work feel worthwhile?
11. At the beginning of the year with a class of students, what are some of the things you look for or listen for?
12. What are some of the kinds of things you have felt good about for students in your classes? What have you noticed that pleased you? Why?
13. Explain what literacy means to you? Give specific examples including strategies, ways of thinking...
14. Define what a reading strategy means to you?

Disciplinary Literacy Questions

15. Explain what disciplinary literacy means to you? Give specific examples.
16. How do you see literacy as specific or general to your subject? Are there some more generic? How do you address both or either in your classes?
17. How do you view reading and its relationship to learning? How do you view reading and its relationship to learning in your subject area?
18. What are some of your favorite strategies for supporting students' disciplinary literacy in your classroom? Could you tell me about one or two of these and why you like them?
19. What are some good examples of discipline-specific texts you use in your classes? Why?
20. When you think about students making progress with disciplinary literacy, do any particular students come to mind? What do you think was helpful for these students? What are they doing that is different from other students?
21. When students seem slower to make progress what do you think is usually happening for them in disciplinary-literacy activities? Why do you think this is so?
22. What are some of the challenges in supporting students' disciplinary literacy? Have there been changes in these challenges over the school year? Or over time in general?
23. What have been some of the most helpful surprises in working to support students' disciplinary literacy? Can you describe for me in detail?
24. How do you address both or either generic and disciplinary specific literacy skills in your class?

Teacher's Own Reading Engagement

25. What makes a discipline specialist? Explain.
26. Do you consider yourself a discipline specialist? Explain.
27. How does your discipline-specific training and interest affect your engagement with texts that you read?
28. What does a mathematician do as they engage with text? How does a mathematician think as they engage with a text?
29. What types of texts do you interact with as a math specialist? Could you rank these as most frequent in your field? What are read the most?
30. What types of texts do you interact with as a subject specialist to inform your teacher content knowledge? Please name as many as you can.

31. When someone gives you as math specific text, what do you think about the text and how do you engage with it?
32. When navigating through your disciplinary texts, what do you notice you do in order to understand that text? Can you demonstrate for me?
33. How important is your knowledge of text writing – as in text organization for example – to the understanding of math specific texts you read?
34. What reading strategies and practices do you use as you engage in your discipline-specific texts?
35. When reading discipline-specific texts, do you tend to read to find details or information, and/or do you make emotional connections to the text? Please give examples and explain.
36. What advice would you give a new teacher who is wishing to assist their students understand disciplinary literacy?
37. In order to further your growth as a discipline specialist, to whom or what do you go for support or inspiration. To whom or what do you align yourself? Explain.
38. Who or what groups come to you or align themselves with you? And which people or groups do you identify yourself with? Explain
39. What do you need as a teacher discipline-specialist to support your growth as a discipline-specialist? Explain.
40. What would be helpful for a discipline-specialist to even more effectively teach their students to engage with discipline-specific texts?
41. When you're thinking about disciplinary literacy, in math specifically, what are some specific math texts do they read? As you're going through a math text, what are some things they're expected to understand as they are reading specific to math?

Appendix E:

Follow-up Interview Questions

1. What reading strategies do you use as you read discipline-specific texts? Are they similar or different to the strategies you use when you read other texts? Explain.
2. How does text structure and organization impact your reading of texts? Explain.
3. What does text structure and text organization mean to you? Explain.
4. What types of expectations do you have of the structure and organization of the texts you read? Has this awareness changed? Explain.
5. How does the text structure and organization guide you as you read? Explain.
6. How important is your knowledge of text writing – as in text organization for example – to the understanding of discipline-specific texts you read? Explain.
7. Explain what disciplinary literacy means to you. Give specific examples.
8. Define what a reading strategy means to you. Give specific examples.
9. What reading strategies and practices do you use as you engage in your discipline-specific texts? Explain.
10. When navigating through your disciplinary texts, what do you notice you do in order to understand that text? Can you demonstrate for me?
11. When do you realize that you are not comprehending, or you're lost in what you're reading? Explain.
12. What do you need as a teacher discipline-specialist to support your growth as a discipline-specialist? Explain.
13. What would be helpful for a discipline-specialist to even more effectively teach their students to engage with discipline-specific texts? Explain.
14. As your students read discipline-specific texts, what are some reading strategies you expect them to use in order to comprehend the text? Explain.
15. In what ways have your view of discipline-specific texts changed? Explain.
16. Explain how you have become more cognizant of what you do when you read as you partook in this research?

17. What have been highlights you experienced and learned through this process? Explain.
18. Have there been things you are disappointed about your experience? Explain.
19. How do you see your teaching changing because of your deeper understanding of your discipline reading? Explain. How about the understanding of discipline reading within your school? Explain.
20. What are your next steps if any?

Appendix F:

Think-Aloud Procedure and Hints (Ebner, 2012; Perkins, 1981)

Before you do the think aloud, I will be asking you some questions and I will read the following to you. Please read this a day or two prior to the actual think aloud.

I am studying how discipline-specialist teachers engage with discipline-specialist texts that inform their teacher content knowledge. During this time, you are going to read two discipline-specific texts you have chosen for the think alouds. When people read text, various thoughts run through their minds as they focus on comprehending what the text is about. Because these thoughts occur inside the reader's head, studying comprehension processes can be challenging. One method that researchers use to uncover a reader's thoughts is to have them perform a "think aloud." This is what I want you to do. Please read the text quietly to yourself, and as you do this, tell me everything that comes to mind -- what you are thinking or feeling in the process of understanding what the text is about."

"When you think aloud, you need to keep in mind the goal of the task. It is to express what it is you think about as you read your text to yourself.

Please read it silently and carefully so that you feel that you are understanding it. Then, each time you have some thoughts or feelings about the text, stop and talk about that. Please comment on anything that comes to mind. For example:

- What do you find interesting and uninteresting in the text, and why?
- Is the text enjoyable to read, or not, and why?
- What reading strategies do you use as you are reading?
- What do you think when you have a question about the text?
- What do you like about the content and style of writing, and what don't you like?
- If you could talk to the author, what would you want to say?
- What does what you are reading remind you of?
- Stop to comment as often as you want, and don't feel that any of your thoughts aren't important or relevant.
- When you stop to comment, please point in the text to where you've stopped in your reading.

If it is helpful for you to write or move as you read, you are welcome to highlight and/or underline sections of text, or jot down your ideas down in the margins. Please explain why you are doing these as you do it.

Think-aloud Hints

1. Say whatever is on your mind. Don't hold back hunches, guesses, wild ideas, images, or intentions.
2. Speak as continuously as possible. Say something at least every five seconds, even if only, "I'm drawing a blank."
3. Speak audibly. Watch out for your voice dropping as you become involved.
4. Speak as concisely as you please. Don't worry about complete sentences and eloquence.
5. Don't over explain or justify. Analyze no more than you would normally.
6. Don't elaborate on past events. Get into the pattern of saying what you're thinking now, not of thinking for a while and then describing your thoughts.

(Perkins, 1981, p. 33)

Appendix G:

Summary of Participant Self-Chosen Discipline-Specific Texts

Teacher	Discipline-Specific Texts
Goodall	<ul style="list-style-type: none"> • Think-aloud I (article) – “Teaching science literacy”: Grant and Lapp (2011) describe four actions that “help teachers foster citizens who are critical thinkers about science-related issues” (p. 1). • Think-aloud II (website) – “Into the twilight”: Weiss (2017) discusses some of the life and discoveries of naturalist Rich Pyle who “plumbs the undiscovered realm of deep, dimly lit reefs” (p. 1). • Think-aloud III (website) – <i>Buzzkill: Will America’s bees survive?</i>: Volk (2017) explains the messy science and politics of conserving the bees of America while the bees continue to die. • Think-aloud IV (scientific article) – “Shape-transformable liquid metal nanoparticles in aqueous solution”: Lin, Liu, Genzer, and Dickey (2017) explain table suspensions of eutectic gallium indium (EGaIn) liquid metal nanoparticles formed by probe-sonicating the metal in an aqueous solution. • Think-aloud V (scientific article) – “Therapeutic treatment of Marburg and Ravn virus infection in nonhuman primates with a human monoclonal antibody”: Mire et al. (2017) observed that the challenge of containing filovirus outbreaks.
Elizabeth	<ul style="list-style-type: none"> • Think-aloud I (chapter from class text) – “The great war”: Merriman (2010) gives the history of the events that took place before, during, and after World War II. • Think-aloud II (chapter from resource) – “Rome, crossroads of the world”: Cahill discusses some of the history of Rome’s importance in the development of Europe. • Think-aloud III (chapter from class text) – “The West between the wars”: Ralph and Lerner (1991) discuss historical events that impacted the western world between WWI and WWII. • Think-aloud Iva (website) – “Venezuela country profile”: the BBC gives a general overview of Venezuela’s politics, historical timeline, and economics. • Think-aloud IVb (website) – “Venezuela profile – Timeline”: the BBC gives a political and economic timeline of significant events from 1498 to 2017.
Carmen	<ul style="list-style-type: none"> • Think-aloud I (novel excerpt) – <i>The witches of New York</i> – This is a historical fiction novel by McKay (2016) who tells a story set in 1880 New York where three witches practice their craft, which pleased some and put themselves in danger. • Think-aloud IIa (website) – “What are verbals? (with examples)”: This article from grammar-monster (2017) gives definitions, examples, and tests that all aid in the understanding of verbals (infinitives, participles, and gerunds). • Think-aloud IIb (website) – <i>Painting with parts of speech: Participles</i>: Lacey-Utley (2009) gives a PowerPoint defining participles and giving examples and exercises to help in the understanding of these verbals. • Think-aloud III (article) – “The Finnish example: What can we learn from Finnish curriculum reform?”: Kardynal-Bahri and Smith (2017) explain their fall 2016 educational expedition to Espoo, a suburb of Helsinki, Finland. • Think-aloud IV (novel excerpt) – “By the Caspian Sea the old potato witches,” a chapter from Rushdie’s (2008) novel, <i>The enchantress of Florence</i>. Rushdie, S. (2008). This novel is the story of a woman struggling to command her own fate in a patriarchal society. • Think-aloud V (novel excerpt) – “Notes upon the diadem club affair,” a chapter from Faye’s (2017) novel, <i>The whole art of detection: Lost mysteries of Sherlock Holmes</i>. This

	novel is an anthology that covers Holmes's profession, from a self-trained juvenile newcomer to a praised investigator.
Gosset	<ul style="list-style-type: none"> • Think-aloud I (excerpt from Masters' course text) – “The algebraic aspect of La Géométrie” is a section from Burton’s (2013) book, <i>History of mathematics</i>. Burton explains the nature of equations and principles underlying their solutions from La Géométrie. • Think-aloud II (website) – <i>The Guinness brewer who revolutionized statistics</i>: Kopf (2015) explains William S. Gosset’s contribution to the field of statistics. • Think-aloud III (excerpt from Masters' course text) – “Student’s <i>t</i> distribution”: Ahsanullah, Golam, and Shakil (2014) explain the student’s <i>t</i> distribution that William S. Gosset developed. • Think-aloud IV (website) – <i>Random sampling error</i>: Shuttleworth (2009) explains the importance of understanding random sampling errors, which are one type of experimental error. • Think-aloud V (excerpt from Masters' course text) – “The legacy of Gauss: Congruence theory”: Hill (2013) gives an in-depth explanation of Gauss’ Congruence theory.
Dickson	<ul style="list-style-type: none"> • Each participant’s Last Think Aloud (article)—“Ready or Not: Recognizing and preparing college-ready students”—Springer, Wilson, and Dole (2014) explain four essential skills students need to be prepared for college-level reading.

Appendix H:

Think-Aloud Transcription Example—Math Think Aloud II

TRANSCRIPTION	ANALYSIS
<p>Kopf, D. (2015, December 11). <i>The Guinness brewer who revolutionized statistics</i>. Retrieved from https://priceconomics.com/the-guinness-brewer-who-revolutionized-statistics/</p> <p>Gosset: This was a blog actually—I think. But for simplicity and in the printing, I just copied the text and put it in a Word document so I kept the URL and that you need—right?</p> <p>Dickson: Can you explain again why you chose this article? This is June 22 and the second math Think Aloud. Could you explain why you chose this article?</p> <p>Gosset: I chose this “The Guinness Brewer Who Revolutionized Statistics” because I am writing a paper on William Gosset. In William Gosset’s work, he was famously known as “student.” I wanted research in the bio on him as well as his math.</p> <p>Dickson: Before we go on to this Think Aloud, I just wanted to review the think-aloud sheet I gave you. <i>I read through the handout with her. I explained how when doing a Think Aloud it is okay to talk about your background knowledge and connections, but not go off on a tangent, and often with Think Aloud that is a problem—the tangent.</i></p> <p>You said you read a couple paragraphs already?</p> <p>Gosset: Yes, I read from the first and second pages in the second [of] the first two paragraphs. I stopped at the bottom of the second page, and I haven’t read the rest of the article.</p> <p>Dickson: The reason why you want to read as compared to the other one, because you said you had another one?</p> <p>Gosset: This one seems to be more interesting to me. Only as I glanced through it there is little bit more mathematics in it, where my research is now going. I finished the first chapter. I’m working on chapters two and three, and this is more specific about those two. The other article that I have here I think is ...</p>	<p>I reminded Gosset that she needed to read the article to herself unless speaking aloud was important for her understanding, and what she revealed to be her thinking as she spoke aloud, more than the reading.</p>

Appendix I:

Think-Aloud Transcription Analysis Excerpt Example—Math Think Aloud II

TRANSCRIPTION	ANALYSIS
<p>Kopf, D. (2015, December 11). <i>The Guinness brewer who revolutionized statistics</i>. Retrieved from https://priceconomics.com/the-guinness-brewer-who-revolutionized-statistics/</p> <p>Dickson: Okay. That sounds logical to me. You can begin whenever you like.</p> <p>Gosset: (03:11): I like that beer. I think that in the first sentence on the first page the connection between math and some of the passion in life is important.</p> <p>(03:30): “Industrial quality control” to me is where my mind wants to go when I’m thinking about his work, and why he chose to do his work.</p> <p>(03:49): I already knew he wasn’t allowed to publish under his own name, so you use the pseudonym.</p> <p>(04:08): I feel like the very last sentence on the first page [that] says, “How did a brewer of dry stout revolutionized statistics?” is exactly what I’m trying to read and write about for my paper, so the question itself answers what I want to talk about.</p> <p>(04:28). From 1899 to 1937 I was aware of his dates of employment. In 1937 I know he passed away at 61 years old.</p> <p>(04:46): When I read, “pretty awesome guy” I think that the author is probably going to be an easy read. I feel like this is being written for readability not necessarily going in depth, so the cautiousness there.</p> <p>(05:18): Out of the one, two, three, four, five statisticians or mathematicians mentioned in the second paragraph—I guess the first paragraph—I’m familiar with three of them. That makes me feel confident—particularly Carl Pearson and R. A. Fisher.</p> <p>(05:42): I don’t like the word hate ... Maybe they should say they are not particularly fond of ... But then there’s fondness in the next sentence, “fondness for Gosset.”</p> <p>(06:07): The second paragraph on the second page seems to be very repetitive in all other research that I’ve done so far with regards to the first paragraph about Gosset himself. There doesn’t ever seem to be any</p>	<p>T-S TT-MA</p> <p>T-S TT-MA</p> <p>T-S TT-MA</p> <p>T-S TT-MA</p> <p>T-S TT-MA</p> <p>T-S TT-MA Thoughts on author TT-MA</p> <p>Inferring, analysing T-S TT-MA</p> <p>T-S TT-MA</p>

<p>more information, other than where he went to school. Kind of defeats some of the purpose I want.</p> <p>Dickson: Maybe you will get more information from the other article you're reading. Is it a Gosset article, too?</p> <p>Gosset: A little bit.</p> <p>(06:54): I love that sentence. The very lessons. "He possessed a wickedly fertile imagination and more energy and focus than a St. Bernard in a snowstorm." That I think is a very good summary about what I'm like. I feel like I would relate to Gosset in many different aspects.</p> <p>Dickson: So where do you start where you have read before?</p> <p>Gosset: (7:21): Now. I did that sentence before and had stopped here.</p> <p>(07:35): As a writer, for myself, I think that "working on Guinness products that would he would develop his great statistical innovations," might be worthy of a quote.</p> <p>(08:11): "Liberal license to innovate and implement their findings" is a very interesting sentence. I think that really does show as I continue reading, I see the environments that Gosset was able to really foster his ideas in. Computing science is these equivalent. (08:40): I don't know if I understood "liberal license to innovate and implement their findings" until I read the next part, but it sounded really interesting, and now I'm now, like, yes, that's confirming what I thought would be a very good place to work.</p> <p>(09:06): As I read this next paragraph, I realize that my first chapter was all about Guinness's success, so this is confirming what I already know. And as with any big company, increasing production by keeping up consumers expectations, I like that they include Gosset's name to answering that question. It makes me feel validated out with my choice.</p> <p>(09:55): Sorry, I read this part out loud. This is last paragraph on the third page. "At the scale at which Guinness was brewing, the "looks and fragrance" method with not economical or even accurate. The scientific brewing team, of which Gosset was a part, would improve this selection process. So, to me I think in this last paragraph is saying that things weren't going well. It was not economical or even accurate to use methods that were previously used for years and years; there must be a change that was required, and he was a part of that change.</p>	<p>T-S TT-MA analyzing</p> <p>AS-MA</p> <p>T-S TT-MA</p> <p>T-S TT-MA</p> <p>Found quote for her paper</p> <p>T-S T within T Predicting</p> <p>T-S T-W</p> <p>T-S</p> <p>Rereading out loud to clarify understanding Paraphrasing Synthesizing and analysing</p>
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Appendix J:

Participant Literacy Practices Used In All Think Alouds

Goodall Science	Elizabeth SS	Carmen ELA	Gosset Math
<ul style="list-style-type: none"> • Paraphrasing (I, II, V, VI) • Summarizing (I, II, V) • I wonders... (I, V, VI) • self-monitoring (I, IV) • Recognizing text organization and structure... (I) • Making connections – T-S (I, IV, V, VI); T-W (I, III, IV, V, VI); T-within-T (I, V, VI); T-T (III, IV, V) • Stop and annotate (I) • Using different colours to highlight different types of vocabulary (I, VI) • Underlines (I, III, VI) • Annotates (I, VI) • Visualization (II, III, V, VI) • Vocabulary – looks up unknown words using google (II, IV). Breaking word up, Google, looks up word on phone tries to find meaning from own knowledge before looking it up; Looks up unknown word again and find that the definition 	<ul style="list-style-type: none"> • Building background knowledge (I, • Making connections: T-W (I, II, III, IV, V); T-S (II, III, IV, V); T-within-T (III), T-T (IV, • Inferring (I, II, IV, V) • I wonder... (I, III, V) • Questioning (I, III, IV, V) • Self-monitoring (I, II, III, IV - was an easy text so she needed very little self-monitoring, V) • Use of Post-It notes for clarification of her ideas, for asking questions that she needs to check for clarification and further research after she is finished reading (I, III, IV) • using mumble reading and private speech (I, II, V) • She'll read quietly out loud to herself skipping some words and sometimes summarizing as she's doing it. (I) • Summarizing (I, II, III, IV, V) 	<ul style="list-style-type: none"> • phonetic understanding of word pronunciation effectively which seems to help with her understanding of words. • She shows a love for vocabulary – the word wayward. Now has a high vocabulary like understanding the meaning of the word grimoire. • Strong background knowledge of content, author, and series • Making connections and using background knowledge T-S, T-W, T-within-T, T-T (I, II, III, IV, V) • I wonder ... (I, II, III IV, V, VI) • Researches information beyond the text (I, II, IV, VI) • Questioning (I, III, IV, VI) • I wonder... (II, III) • High vocabulary • Strong curiosity to learn. • Recognizing flashback 	<ul style="list-style-type: none"> • Scans (I, V, VI) • Inferring (I, II, III, IV) • Strong background knowledge (I, II, V) • Making connections T-W (I, III, IV, V, VI); T-T (I, III, IV, V); T-within-T (I, III, V, VI); T-S (III, IV, V, VI) • Underlines (I, VI) • Writes notes in margins, writing out math problems or words into symbols or equations (I) • Uses another sheet of paper or notebook to figure out the math or take notes (I, II, V) • Intent on understanding the math and going through the steps to do that (I) • Circling (I) • Predicting (I, II, I) • Paraphrasing (I, II, IV, V, VI) • Boxes words (I, VI) • Rereads (I) • Self-monitoring (I, II, III, IV, V, VI) • Note-taking (I, III) • Questioning (I, II, III, IV, V, VI) • Discussing with author (I) • Puts brackets around words (I, VI) • Synthesizing (I, II, III, IV, V, VI)

<p>doesn't help her, but this doesn't stop her from continuing to read and make sense of the complete article. (V)</p> <ul style="list-style-type: none"> • Self-monitoring (II, V) • Skim (II, IV) • Scan (II, III, IV) • Reading graph (III) • Skipping (III, IV, VI) • Putting words in boxes (III) • Questioning (III, V, VI) • Slow down reading speed (III, VI, V) • Rereading - which occurred with the harder text (IV) • Predicting (IV) • Recognizing referencing • Diagram and picture use and importance (IV) • Using French reading skills • Inferring and questioning connected (V) • Drawing conclusions (V) • Strong background knowledge is imperative (V) • Being aware of acronyms from the beginning of the article (V) • Substituting the term for the acronym 	<ul style="list-style-type: none"> • Skipping words/phrases if deemed unnecessary (I) • Analyzing (I, II, III, IV, V) • Synthesizing (I, II, III, IV, V) • Predicting (I, II, IV) • A willingness to do further research (I) • Strong use of background knowledge (I, II, III, IV) • Does further research as she is reading (II) • Paraphrasing (II, III, IV, V) • Application of knowledge (III, IV, V) • Reading sidebars • Visualizing only after I asked her about it (II, III, IV) • Highlighting • Looks forward in text for information (III) • Self-monitoring (III) • Goes to map to get geographic information (IV) • Compare/contrast (IV, V) • Extrapolation if information (VI) • Made a purpose (V) • Underlining text (V) 	<ul style="list-style-type: none"> • Inferring (I, II, III, IV, V) • Aware of text organization changing. • Curiosity to learn (I, II, III, IV, VI) • Paraphrasing (II, III, IV) • Summarizing (II, III, IV) • Private speech (III, IV, VI) • Analyzing (III, IV, VI) • Underling (III, IV) • Synthesizing (III, IV, VI) • Application (III, IV, VI) • Summarizes antecedent information (IV) • Uses analogy to paraphrase (IV) • Finds humour and sarcasm (IV) • Questions the author and his view of women (IV) • Aware of narrator and point of view (IV) • Transfer reading skills no matter text type (IV) • Predicting (V) • Visualizing (V) For VI she said she did after I asked her and that she will visualize while she reads a novel rather than an article. • Skimming (VI) 	<ul style="list-style-type: none"> • Analyzing (I, II, III, VI, V, VI) • When referring to left-hand, she lifts left-hand with thumb and index finger making an L (I) • Uses context to answer her questions (II) • Quietly speaks as she is writing (II) • Application of knowledge (II, IV, V, VI) • I wonder... (II, III, IV, VI) • Drawing a diagram (II, IV) • Visualization (II) • Editing (II) • Summarizing (II, IV, V, VI) • Further research to clarify (II) • Looking up unknown words (II, VI) • Looks at pictures, graphs to understand their significance. • Skipping (III, VI) • Explaining understanding and background knowledge (III) • Draws curve (III) • Assuming (III, IV, VI) • Explaining background knowledge and connections to calculus (III) • Private speech articulating her learning and understanding (III) • Reading out formula and revealing her thinking (III)
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<p>when she comes to it (V)</p> <ul style="list-style-type: none"> • Circling (V) • Making arrows (V) • Using pen to interact with text (V) • Sequencing (V) • Inferring (V, VI) • Boxes around words (VI) • Box brackets around quotes (VI) • Question marks beside texts (VI) • Evaluating (VI) • Analyzing (VI) • Application of knowledge (VI) • Synthesizing (VI) • Moving physically by using a pen, pencil, or highlighter (VI) • Numbering order in text (VI) • Organizing and compartmentalizing ideas (VI) 		<ul style="list-style-type: none"> • Looks at source – journal name and date (VI) • Looked at author credentials (VI) • Underlining (VI) • Self-monitoring (I, II, III, IV, V, VI) 	<ul style="list-style-type: none"> • Goes back and forth from text to table to keep understanding flowing (III) • Curiosity • Highlights (VI) • Questioning layout and not sure of title (VI) • Rereading (VI, V) • Annotating (IV, VI) • Recognizes purpose (IV, VI) • Mumble reading and private speech (IV, V) • Uses pencil to follow words as she is reading (V) • Puts a check mark beside ideas she understands (V) • Skimming (V, VI) • Teaching herself math (V) • Evaluating (V, VI) • Understands text organization and formatting (V) • Using calculator to check math (V) • Does more math to confirm understanding of proof (V) • Even though she can't pronounce a word she continues reading and the math (V) • Willing to go back to ensure understanding – perseverance and resiliency (V) • Question from title she wants answered before reading any of article (VI) • Looks at references (VI)
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			<ul style="list-style-type: none">• Recognizes italicized words and wonders about the purpose of the italics (VI)• Finds from where the article is written (VI)• Wanted to understand and apply to her teaching.• Critically look at the ACT 2013 survey because of her statistician viewpoint (VI)• Appreciates the use of examples and vignettes (VI)• Reflecting (VI)
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Appendix K:

Carmen's Literacy Practices Employed for Hardest Article

Rushdie, S. (2008). *The enchantress of Florence*. Toronto, ON: Vintage Canada.

- **Explains why she asks questions out loud.** Because when I hear things sometimes, I can think about them differently, so it kind of puts me on a different. It organizes my brain differently I, I guess. I'm used to talking to myself. I talked to myself all the time.... As usually if I'm mumbling, I'm not skipping ahead but I'm processing that immediately, so I want to read out loud to hear it, so I mumble and then understand it. P. 1.
- **Learning a piece of music and memorizing it by hearing it over and over again.** It's very much an auditory because if I'm learning a piece of music, hearing it works I had to do to get are not in very good sight reader and if I can hear it from sight reading and then just listen to after I learned way faster and I memorize it better. I wonder if that was that. Pp. 1, 2.
- **Understands that she struggles with the read but perseveres to continue reading.** It takes place in Florence during the Renaissance, so since we studied that in grade 8, I thought that's be cool. I'd be into this. It sounded really cool and I have to say that I've been kind of reading it on and off for maybe seven or eight months. I end up picking it up when I have nothing else to read. I've kind of been struggling along with it. It's really weird and I think you'll see why as I go. I've been reading it since August ... P. 3.
- **Gives antecedent information and summarizes story.** We are on chapter 15 and so what happened is there is this person who has come from Italy in a gold coat, and he makes a big thing out of this gold coat, which I can't remember why. It's been a while since I've read this, but he ends up in the Mugov (sp.) capital which is a part of India and he's telling the story... I think structurally it's sort of like Sheharizan or the Arabian nights or something like that because it's very meta-. It's a person telling a story and then you kinda get sucked into the story. And I find that it's a little hard to know when is this actually happening and when is it the story he's telling.
- **T-S, T-W, making connections.** His name is Akbar the Great, but I think because earlier they talk about these three friends. One of whom is Machiavelli which is partly what sucked me into this because I'm very fascinated by Machiavelli. And I'm a bit Machiavellian myself in some ways. And so that's Il Machia and he has friends, Nicholo, and they had another friend named Argalia and then there's third friend I think but I can't remember his name. But a couple of them and up in this like brothel in Florence and they meet this woman who does not talk. Somehow, they get her to talk but I don't remember how. She tells them the story about how she is an enchantress and she's like this lost princess from the Mughal Empire and they thought that she had died, and it turns out that she was captured and then she escaped and made her way to Florence. She's kinda telling the story and now Argalia who calls himself Akbar the Great is back in the Mughal capital telling them about this woman who they thought that was lost. If I have the right of it.
- **Self-monitoring.** But if I were a worse reader than I am I think this book would kill me. Either that or I would just quit, but lately I've been better about quitting books that I'm not interested in rather than just struggling through it but I kinda want to say that this is one just to say that I did and throw it on my list of 50 books.

- **Text structure awareness.** So, one cool thing about the chapters is that the chapters are all the names of the chapter and it is the part of the very first sentence of the chapter. I'm not sure why he really did it, maybe to make it as a transition or connection but I think it's really cool.
- **T-within-T, questioning.** So, to begin on page 211. So, I'm interested in what does it mean the "old potato witches" is because I haven't read this for a while I wonder if they've been mentioned before?
- **T-within-T.** So, this Shaibani Khan I think he was married to this woman or kidnapped and married her—I think.
- **Text features.** The stuff in italics the regular text is what Akbar the Great is relaying as the story. The italics is the interjection from his listeners.
- **I wonder ...** I wonder if that's where they get for Ismaili Muslims in the city of Marv. P. 5.
- **T-T, T-S, T-W.** I actually know that that city exists because there is this British quiz show that I like to watch, and they had a series about the letter M and there was one that they talked about here are four places that have a start with the M and which of them is fictional and some of them actually guessed Marv. No, they said Marv actually exists and they have this whole conversation about Marv ... P. 5.
- **TW, T-S.** Nichola Machiavelli of Florence could not have said it better ...” (p. 211). I would agree with that. P. 6.
- **T-within-T.** Ah, okay so if we turn the page it talks about what the potato witches are on page 212—potato witchcraft. P. 6.
- **T-W.** A lot of it's not really Russia's, though. It's the sort of that middle Eastern part of Russia Astrakhan ... Sort of that Silk Road route. The parts that were sorta Soviet but not really ... Had roots in Sufi mysticism. Are those the ones that wear those pointy hats who spin around? I'll have to look those up. I saw them on TV once and I think that's what it is. Those Sufi mystics. P. 6.
- **Inferring.** Where the Uzbeks lived, that must be Uzbekistan. P. 6.
- **T-S, questioning.** “Sunni-Uzbek potato-based spells it was possible to find a husband, chase up a more attractive love rival, or cause the downfall of a Shiite King” (p. 212). Why not? Potatoes can do all of that. P. 6.
- **Finding humour.** “He had fallen victim to the rarely used Great Uzbek Anti-Shiite Potato and Sturgeon Curse” (p. 212)—*laughs*. Oka y... P. 6.
- **T-S, T-W.** I think so to put a lot of those areas are very spiritually connected even if they are not geographically connected. P. 7.
- **Synthesizing, analysing.** Well, it could have been the curse or it could have been “that the Ottoman army greatly outnumbered the Persians or that the Ottoman soldiers for work for rifles ... Or that the head of the Ottoman forces was the invincible Janissary general, slayer of Vlad and Impaler ... namely Argalia the Florentine Turk” (p. 212, 213). Okay so that's him. Greatest Shah ... P. 7.
- **Sarcasm.** No, no it was the potato curse though not the guns not the greater numbers. It was the potato curse. P. 7.
- **I wonder ..., questioning, T-S, T-W.** They must not have been genuinely red-headed. But **I wonder** what that is reference to? I might've missed it somewhere. We actually had a family here with the last name Qizilbash. **I wonder** if they were from that area? It just one of those random things that popped into my head. P.7

- **Humour.** I love how he brings the guy's head with him in a jar—funny. That's awesome. P. 7.
- **Inferring.** I think that's this woman who is now stuck in Florence. I'm pretty sure that's her. Yes, "the foreigner who was the reason for her refusal to return to Khanzada to my grandfather's court, the reason for her removal from the record ..." (p. 213). P. 7.
- **Questioning, T-within-T.** And that's something here to that the Emperor has a ghost wife. I can't figure out if that's supposed to be a metaphor for something or what. Because it keeps talking about his other wives are jealous of this ghost wife. And I am like is she actually a ghost. Did she used to be alive and died? I can't remember now. P. 7.
- **Application of knowledge.** It is not "Arcalia or Argalia, but the Shah of Persia himself" (p. 213). Right, Shah is male. P. 7.
- **T-S.** "The victor and then the victor's vanquisher ... It would appear that the young lady had a weakness for being on the winning side" (p. 213). Nothing wrong with that. P. 7.
- **T-within-T.** Khanzada (p. 214). She is the old aunt—I think—in the court I think I remember reading about her. She is like ... The Emperor has his mother I think she's the mother's sister ... So, he sets her free ... P. 8.
- **T-within T.** Yes, yes, yes, Qara Koz, she's the lost princess. She wants to stay. That's right she's a lost sister. She does not want to go back to India. She wants to stay with the conqueror. P. 8.
- **I wonder ..., questions about the author and his views on women**
- **Inferring.** In the middle of 215 where the italics are ... (20:07). This is the only thing by Salman Rushdie that I've ever read, and **I wonder.** I'm almost interested to read some of the other stuff to see his thoughts on women because I'm not really sure how much he likes them. He doesn't seem to think much of them.
- **T-within-T.** The Shah was defeated earlier I know it said that earlier that she must go with the winter because it said that she had it previously it had said that she had a weakness for being on the winning side.
- **Inferring.** Fair enough ... "That a woman so beautiful should not be tender ... I did not expect her to turn away from me so casually ... expected to be the beloved ..." (p. 215). Oh well. It is what it is.
- **Self-monitoring, summarizing, inferring, T-S, T-W, synthesizing, and analyzing.** At the top of 216, the princess goes back to India without her soldier, or soldier, without her sister And since the sister didn't come back and took her name off of all the historical record which doesn't surprise me actually. There is a lot of stuff that suggests that there is a lot of amazing women that have been forgotten by women because their names have been removed from historical records by jealous men or horrible men—like that ... P. 8.
- **Summarizing and synthesizing.** So, he and Shah Ismail were kind of like they were being friends ... So back in the italics ... "For our grandfather's decision to send the Safavid ... *Reading quietly out loud to herself.* So, this person this mystery person has shown up in Egypt and India and is telling the Emperor the story about this woman and it turns out that the woman is there lost princess from years ago and they are like not only did she actually exist but all of these decisions like the way she acted really influenced history. It was because of the lost Samarkand.
- **T-S, T-W.** So, these people in India are actually from Samarkand. I can't remember where that city is. It's in the East. It's like Uzbekistan or one of those little something "stans" under Russia... *Reading out loud.* P. 9.

- **T-within T.** Mogor dell'Amore that's his name. That's the third guy. That's his real name. Called himself something, something great but this is his real name.
- **T-within-T.** So ... here she is with the Shah Ismail ... Oh yeah, her maidservant the Mirror because they look very similar. I remember now. P. 9.
- **Inferring.** And then the Ottoman Sultan ... And then the last paragraph on page 217. She seems like a very wily woman. She looks out for herself, and she does what she needs to do ... At the very end of 217, they describe Shah Esmail and the immensity of his self-love and so that makes me think that he is very arrogant and she's using his arrogance against him. If we turn the page 218 ... P. 9.
- **I wonder, T-T. *The Three Musketeers***—I wonder if's a different version Athos, Porthos, and Aramis. The D'Artagnan used seems to be a giveaway but half of me feels that's too easy. I don't know. P. 9.
- **I wonder, inferring, T-W.** “Argalia learned that the Grand Vizier, in defiance of Muslim tradition, had refused to bury the dead Sultan's body for three days so that ... (p. 219). “Stamboul” I'm guessing is Istanbul? There is a reporter on CBC who is in Turkey, and she always pronounces as Stamboul, someone CBC Stamboul, so I'm wondering if that's the older version. I know that Istanbul is Constantinople is Byzantine ... and I wonder if this is more the Turkish version of Stamboul. The non-English version.
- **T-S, inferring.** I'm sure he died of a broken heart (*said sarcastically*). I mean that is not possible to die of a broken heart, but I'd rather feel that in this case he was helped along.
- **Paraphrasing, T-S.** “The world had no room for men who would lose his nerve” (p. 220) that makes me feel that he was helped along. So, then his son ... And then they strangle all of his brothers ... Why not? ... Risk of the coup eliminated ... P. 10.
- **T-W, T-T.** So, in the parentheses where it says “(Many years later, when Argalia told il Machia about these deeds, he justified them by saying, ‘When a prince takes power he should do his worst right away, because after that his every deed will strike his subjects as an improvement on the way he started out ...’). That's very Machiavellian. That's straight up Machiavelli. P. 10.
- **Summarizing, T-within-T, reading quietly aloud to herself.** So, they arrested lots and slaughtered more. So, the Ottoman soldiers made camp. Yes, and all of them had guns, musketeers, and cannons ... And then the Persians come, and they have no guns because it said earlier that they were not manly ... P. 10.
- **Summarizing, T-within-T.** And then it doesn't matter (top of page 221) Shah Esmail gets defeated anyway. They think that they might win because the Ottomans marched really far. They had little to eat or drink. They were tired, but ultimately, they were a bigger Army and they had better weapons, so the Ottomans won. The Princess dumps Shah Esmail – it said earlier – so obviously she's with Argalia. Yes, this is the enchantress of Persia ... P. 11.
- **Inferring.** So, the last paragraph on 221 sounds like she is trying to sort of tell him what to do and is not listening ... P. 11.
- **T-S.** “Pack now ... don't just gallop ... Don't you have guns... (*laughs*).
- **T-S, analyzing, synthesizing.** “It would not be sportsmanlike to attack them when they are not ready to fight” (p. 221). Men are so stupid sometimes. Sportsmanlike—piff. “It would not be noble to set our men to attack them from the rear ... The gun is not a weapon for a man.” Ha ha ha. They deserve to lose—saying things like that, they deserve to lose.

- **T-within-T.** “Courage will win the day, not—ha!—these *arquebuses* and *muskets*—if we turn the page ... “Whatever is decreed by God will occur.” They do lose. That we know. P. 11.
- **Inferring, T-S.** Oh, no wonder she left him. If we look at the bottom of page 222, “He fled the battlefield without coming back for her.” No wonder she left him. I think I’d leave someone like that, too. P. 11.
- **Inferring, summarizing.** Argalia kind of finds her ... She must obviously be very beautiful since men who look at her fall in love with her immediately. P. 11.
- **Summarizing.** Again, after the break, ... (35:08). So, they double almost double the size of the Ottoman Empire. Fair enough.
- **Wants to do more research.** I’m interested to look at some of these borders to see where they compare to this. We don’t talk about Turkey—hardly at all—in history classes, so would be interesting. I think a little bit more about it. I hear it’s a beautiful country. It might be a little bit scary to go to it now. I guess it depends on where in Turkey you go. P. 11.
- **Analyzing, T-S, T-W.** “I defeated god ceases to be divine” (p. 224). Yes absolutely. And we talked about this in class so many times. That once your leader falls your army becomes absolutely demoralized and it becomes so much easier ... Look at the Battle of Hastings. Once he got that arrow through the eye, that was it, the Saxons were toast. I think they had bigger numbers are slightly bigger numbers, but they made some dumb mistakes and then that arrow through King Harold’s eye was the nail in the coffin to extend that metaphor. Pp. 11, 12.
- **Curious, inferring, using background knowledge, T-W, I wonder ...** Because some people from that part of the world tend not to be redheaded. That’s very much a northern European thing. That’s why I’m curious about this redheaded thing, but I wonder if they are blooded and violent? P. 13.
- **Google definition.** So, the *qizilbash* is a label given to a wide variety of Shiite militant groups that flourish in Azerbaijan, Anatolia, and Kurdistan. So, these are in Anatolia because this is Turkey. The word *qizilbash* is Ottoman Turkish meaning crimson or red-headed. The expression is derived from their distinctive 12-gourd crimson headwear. So, you are right. Indicating their allies to the 12 imams and to Sheik Hadar ... P. 14.

Appendix L:

Goodall and Elizabeth's Cognizance of Reading Skills and Strategies Throughout Data Collection

GOODALL SCIENCE Pre-Think-Aloud Reading Skills and Strategies Used	GOODALL SCIENCE Most Difficult Text Reading Skills and Strategies Used	GOODALL SCIENCE Reading Skills and Strategies Used but not Voiced in the Pre-Think- Aloud Interview
<ul style="list-style-type: none"> • break words apart or use a dictionary to find unknown word • research unknown material in text to understand the text • regulate reading speed depending on the text difficulty • annotate • highlight • question herself • categorize information • persevere to continue the quest for understanding what is being read • understand the purpose as to why text is being read • recognizes having a bad memory and, if needs to, refers to text information later rereading text two or three times if necessary • scans for information wanted 	<ul style="list-style-type: none"> • changing reading speed • skipping • making predictions • rereading • using pictures and tables for information • French/English contrast • skimming and scanning • discipline-specific background knowledge/personal associations • making connections T-T, T-S, T-within-T, T-W • annotating • self-monitoring • questioning • finding meanings of difficult words – dictionary, Wikipedia, context clues, prefix, suffix, root clues • questioning • text feature and organization awareness • using mumble reading and private speech • curiosity • going beyond text to understand text • perseverance/resiliency • intrinsic motivation • recognizing own purpose for reading 	<ul style="list-style-type: none"> • skipping • making predictions • using pictures and tables for information • skimming and scanning • discipline-specific background knowledge/personal associations • making connections T-T, T-S, T-within-T, T-W • text feature and organization awareness • using mumble reading and private speech • curiosity • perseverance/resiliency

ELIZABETH SS	ELIZABETH SS	ELIZABETH SS
Pre-Think Aloud Reading Skills and Strategies Used	Most Difficult Text Reading Skills and Strategies Used	Reading Skills and Strategies Used but not voiced in the Pre-Think Aloud Interview
<ul style="list-style-type: none"> • highlight • annotate by writing on side, doodling • look up definition needs • manipulate text so it can be assimilated • create timelines and webs • recognize purpose for the reading • delving deeper and deeper into text to enable understanding and get more than general gist • rereading • using stickies to highlight areas that need to be reviewed or researched • form images in mind of what is being read; those images fill in the gaps in understanding of information • using already known information • fill gaps in knowledge with facts. 	<ul style="list-style-type: none"> • application of knowledge • synthesizing - with own knowledge • analyzing • paraphrasing • summarizing • looks forward and back in text • Post-it notes • skipping ahead • discipline-specific background knowledge/personal associations • making connections T-T, T-S, T-within-T, T-W • annotating • self-monitoring • questioning • finding meanings of difficult words – dictionary, Wikipedia, context clues, prefix, suffix, root clues • questioning • text feature and organization awareness • reading quietly out loud to self • curiosity • going beyond text to understand text • perseverance/resiliency • intrinsic motivation • recognizing own purpose for reading 	<ul style="list-style-type: none"> • paraphrasing • summarizing • looks forward and back in text • skipping ahead • making connections T-T, T-S, T-within-T, T-W • questioning • text feature and organization awareness • reading quietly out loud to self • curiosity • going beyond text to understand text • perseverance/resiliency • intrinsic motivation

Commented [MD1]: •She said she did this without using the labels – she said that she using already known information, delving deeper and deeper into text to enable understanding and get more than general gist, fill gaps in knowledge with facts

Commented [MD2]: She did not specifically say that she makes connections and to what she makes connections

Appendix M:

Goodall's Initial Interview Literacy Practice Awareness Compared to Literacy Practices Used in Most Difficult Text

Goodall

GOODALL SCIENCE Pre-Think Aloud	Hardest Text Reading Skills and Strategies Used
<ul style="list-style-type: none"> • break words apart or use a dictionary to find unknown word • research unknown material in text to understand the text • regulate reading speed depending on the text difficulty • annotate • highlight • question herself • categorize information • persevere to continue the quest for understanding what is being read • understand the purpose as to why text is being read • recognizes having a bad memory and, if needs to, refers to text information later rereading text two or three times if necessary 	<ul style="list-style-type: none"> • changing reading speed • skipping • making predictions • rereading • using pictures and tables for information • French/English contrast • skimming and scanning • discipline-specific background knowledge/personal associations • making connections T-T, T-S, T-within-T, T-W • annotating • self-monitoring • questioning • finding meanings of difficult words – dictionary, Wikipedia, context clues, prefix, suffix, root clues • questioning • text feature and organization awareness • reading quietly out loud to self • curiosity • going beyond text to understand text
<ul style="list-style-type: none"> • scans for information wanted 	<ul style="list-style-type: none"> • perseverance/resiliency • intrinsic motivation • recognizing own purpose for reading

ignore highlighting

Appendix N:

Tracking of Lent (2016) and Shanahan and Shanahan's (2008, 2012) SS Literacy

Characteristics on List

Social Studies (p. 19):

- do did this author's... did
and didn't tell to me until
then until 5...
for did
then.
1. Compare and contrast events, accounts, documents, and visuals such as infographics or photographs ~~5, 6, 7, 8~~ 5, 6, 7, 8
 2. Interpret primary and secondary sources with an eye toward bias ✓ (3)
 3. Create narratives from existing information ✓ (2)
 4. Use knowledge of the present to make sense of the past and vice versa
 5. Situate new understandings within background knowledge ✓ (5) (4) (6) (7) (8) *synthesis*
infer (4)
background
Knowledge.
 6. Think sequentially to piece together timelines ✓ (5), (8)
 7. Make inferences and determine what is important from what is merely interesting ✓ (7)
 8. Untangle threads of fact from often conflicting accounts and perspectives ✓ (5) (9)
 9. Determine meanings of words within context ✓

Shanahan and Shanahan (2008) emphasize the importance of a historian to be aware of the author or source. One of the major purposes of a historians reading was to decipher what story the author is wanting to tell. Shanahan and Shanahn (2008) point out the historian needs to read knowing they are getting an interpretation of history and not "Truth" (p. 50). A historian needs to be aware of two biases - the text's author(s) and their own. Shanahan and Shanahan (2008) also emphasize that "historians infer cause-and-effect when they study events and what precedes and follows them" (p. 56).

Appendix O:

Tracking of Lent (2016) and Shanahan and Shanahan's (2008, 2012) SS Literacy Characteristics on Transcription

Social Studies Think Aloud Transcription I – April 26, 2017

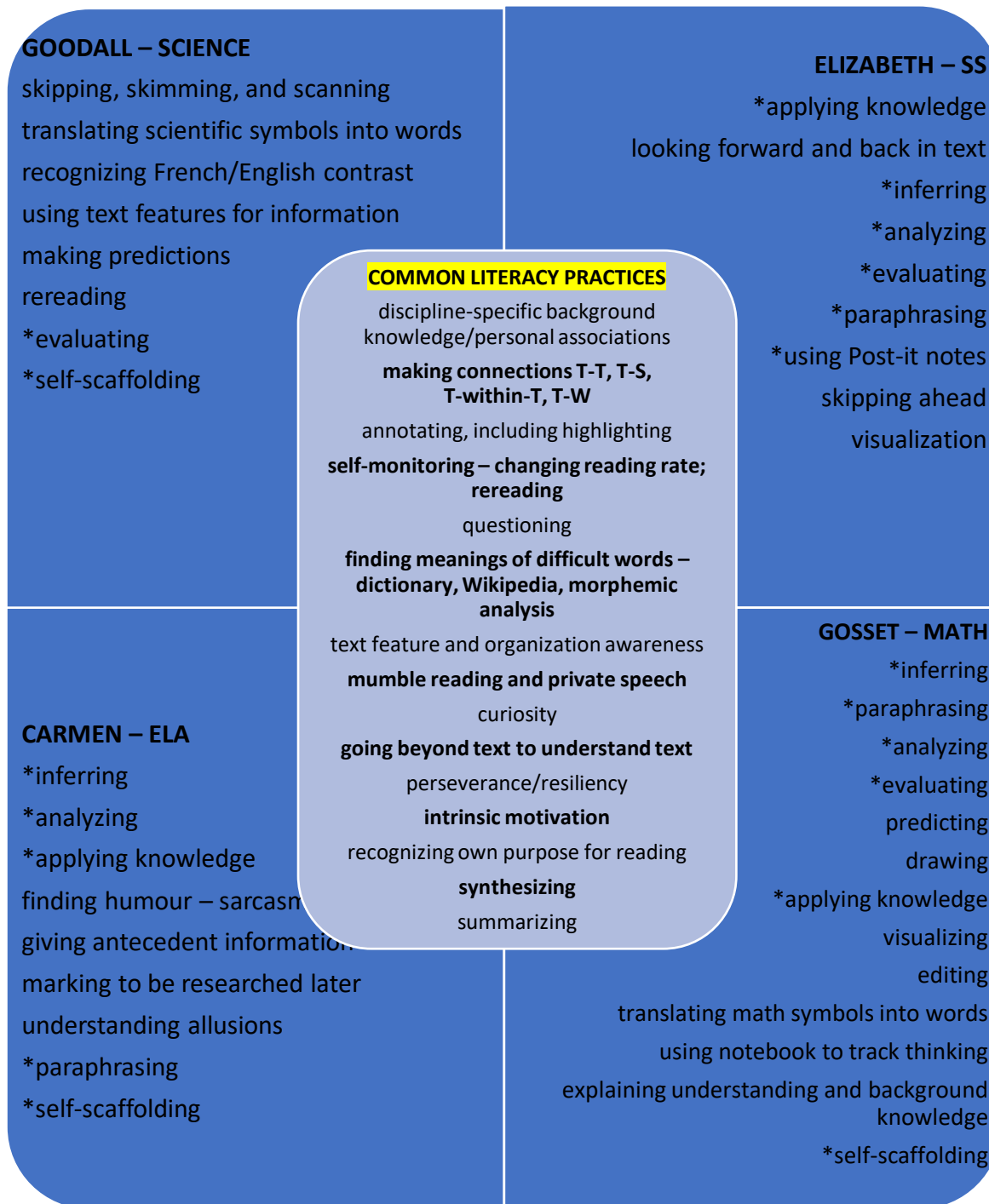
Dickson

<p>new nations encouraged the debilitating economic rivalries. I suppose by separating those countries I would have to think about what debilitating economic rivalry and the fact that the area of let's say Poland was taken away from Germany ... then became that corridor that Germany would've wanted back because that was a major corridor, so I'm thinking that that's got to be one of the authors are trying to allude to. ✓ inferring</p>	<p>Analysing, synthesizing</p> <p>Author reference TT-SS</p>
<p><i>Reading quietly outloud to herself... (12:50).</i> Now I'm going to think about how this sentence: "Finally, nationalist sentiment encouraged discontent among minorities in the newly established states of central Europe." (p. 536) I'm thinking about a whole bunch of ethnicities in the country. These different ethnicities feeling loyalty to their own ethnicity then caused conflict within the country, so then I think about Yugoslavia as an example or those in the Czech Republic as well which is interesting because then I had to make a connection to how am I gonna add this – which is really good point – that I would like really like to make sure that I add this to present this to my students so to me this is a piece that I'm going to highlight... Just so I don't forget to teach it to add it...</p>	<p>Highlighting</p> <p>Make connection to add to information presented to her students I-SS. She wrote on a Post-it note as a reminder to present this information to her students.</p>
<p>(14:02). "Countries weakened by conflict between national minorities were an unlikely proving ground for democracy, a political system that functions best in an atmosphere of unified national purpose" (p. 536) that's fascinating, too. I want to add that idea and how it was worded that once the minorities – so that I have to make that connection to how I teach it – once the minorities are struggling toward the democracy, they don't have that atmosphere of the unified goal objective so therefore they are already like their Democracy will fail for them there – interesting.</p>	<p>Another Post-it note was added to the text here. T-W T-S</p> <p>Analyzing, synthesizing, applying SS-I TEACHER</p>
<p><i>Reading quietly outloud herself... (15:05).</i> So when I think about totalitarianism and the fact of as another reason why the interwar timeframe did not work well is that rise of totalitarianism to them put into question democracy because of so much class conflict and economic chaos and nationalism – interesting.</p>	<p>Synthesizing, summarizing</p> <p>T-S and T-W</p>
<p><i>Reading out loud quietly to herself... (15:43).</i> This one here is exactly what I teach grade 12 and am able to make the connection to that curriculum the fact that all three systems can be defined as totalitarian I like how that's added to what I know although and I can have that visual</p>	<p>I-SS</p> <p>Visualizing</p>

<p>of where it is exactly in my curriculum so I think of it I told I think of totalitarian and what exactly where is it in my unit with the 12 when I'm teaching them. That's my image that I have in my mind...</p>	T-S and T-W
<p><i>Reading quietly to herself... (16:21).</i> I like that sentence, too. I like that sentence just because sometimes I struggle with teaching the idea of totalitarianism versus the idea of a dictatorship and I want to make the difference see the difference between the two. One being the political system and the other being a regime.</p>	T-S and T-W
<p><i>Reading quietly to herself... (17:17).</i> I like how this author how he presented the beginning of the chapter and then is moving through the chapter where it is for this, second this, third this. Like next idea this. He develops it in such a way that is easy to follow mostly if I had understood the very beginning what I was reading... I guess that's what happens when you get right in the middle of the book...</p>	Text expectation Awareness of self-monitoring
<p>Dickson: You were self-monitoring like a good reader and your checking because you're living things and went back. That's what a good reader does.</p>	
<p>Elizabeth: (18:12). ... "the ideology with the nationals but versions of Marxist socialism" (p.256)....</p>	
<p><i>Reading quietly outloud to herself... (18:44).</i> If information I know but just framing it in such a way that I can understand it. He is easy to read. The authors easy to read.</p>	Connection and appreciation of authors TT-SS
<p><i>Reading quietly outloud to herself... (19:52).</i> So interesting that this book went straight into talking about... They skipped the timeframe and I don't know why they skipped the timeframe. It went from presenting the west between the wars and talk what ideologies and then start talking right away about then rise of totalitarianism and they did not talk about the four months from the time that Kerensky... Czar abdicated to when Lenin took over and is presenting Lenin as a strong and able leader with very strong beliefs who was a revolutionary, administrator, and strategist and he demanded respect and loyalty and it's funny but so often we weren't introduced to Lenin in that way. Lenin not only when he took over they went straight into civil war not long after in 1917, so he was also in that timeframe of that Civil War and that he had even introduced to Communism but Communism light in order to</p>	Text organization/expectation Synthesizing, using background knowledge, T-W 82 ✓

Appendix P:

Content and Disciplinary Literacy Nonvernacular Social Languages Used While Reading Hardest Texts



(Brailsford & Stead, 2009, 2010; Harvey & Goudvis, 2007; Keene & Zimmermann, 2007; Bloom, 1984; Shepherd & Van De Sande, 2014; Chang, 2007; Dreyfus, 2002; Lawrence, 2007; Ellery & Rosenboom, 2011; Coiro, 2011; Walters, 2006; Anderson & Krathwohl, 2001; Mateos et al., 2008; Methe & Hintze, 2003; Springer et al., 2015; Neuman et al., 2014; McVee et al., 2013; Marzano, 2004; Langer, 1984; Monem, 2015; Kadri et al., 2017; Vygotsky, 1978/2012; Kragler, 1995; Prior and Welling; 2001; Fani & Ghaemi, 2011)