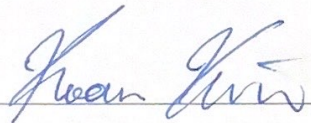UNDERSTANDING MEDICAL LABORATORY SCIENCE (MLS) DISCIPLINARY

READING PRACTICES USING COLLABORATIVE RETROSPECTIVE MISCUE

ANALYSIS (CRMA)

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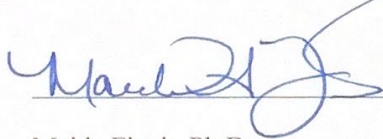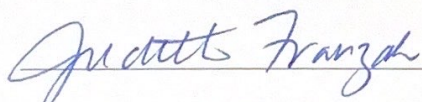
ANALYSIS (CRMA)

By

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A dissertation submitted to the Faculty of the Seidel School of Education

Department of Doctoral Studies in Literacy of Salisbury University

in partial fulfillment of the requirements for the degree of

Doctor of Education

November 29, 2021

UNDERSTANDING MLS DISCIPLINARY READING

ACKNOWLEDGEMENTS

I would like to thank my advisor and mentor, Dr. Koomi Kim for introducing me to Miscue Analysis and supporting my own journey towards understanding the reading process. I am forever grateful for her never-ending support, encouragement, and guidance. Similarly, my dissertation committee, Dr. Maida Finch, Dr. Judi Franzak, and Dr. Heather Porter, have shown me what it means to build a supportive disciplinary community. I have felt loved and encouraged on this often arduous path. You have provided a shoulder to cry on when needed. You have been ardent supporters, fulling believing I could be successful, especially when I felt most challenged. For this, I am thankful.

I am forever grateful to each of my research participants, without you, I would not have a dissertation to share. I appreciate the time you devoted to this research study. Thank you for agreeing to be a part of this study and allowing me to learn alongside you.

My work family has believed and encouraged me from day one. I appreciate your sacrifices toward ensuring my success. Thank you to Dr. Diane Davis, Dr. Christina Camillo, Beth Prouse, Janet Rogers, Meg Harlin, and Valerie Butler. You have been a listening ear when I needed to work through difficulties and have always been ready to celebrate each success – no matter how small! I would also like to thank Dr. Randy Insley; your support and encouragement were unwavering and much appreciated.

I am grateful for the friendships I have developed through this program. Megan Hines and Rebecca Wivell, no one else can fully understand the struggles we have encountered over the past six years, and I am blessed to have gone through them with you

both. You have helped me get here and I cannot wait to cheer you both over the finish-line.

I would like to acknowledge the support and guidance from Dr. Melissa Bugdal. You have helped me to take ownership and pride over my writing. I would also like to thank Dr. Megan Miller for your kind words and taking the time to review my writing. I first heard about CRMA from Dr. Kate MacDonald and this was the impetus for my dissertation. I appreciate all your time, guidance, and encouragement along this journey.

I am thankful for my dear friends, Chrissy Gambrill, Erin Neal, and Billie VanZooligan. I have been an often absent presence over the last few years. Your steadfast love and support has meant the world to me. Thank you all for your continued friendship.

I would like to thank my mom and step-dad, Dianne and Roy Hotchkin for their love and support. Thank you for picking up children, going to conferences, and listening to me ramble on for hours about my classes and papers. Thank you to my dad, Scott Smith, for always believing in my success and cheering me on. Thank you to my brother, Curtis Smith, for your love and support through the years.

I am most grateful to my husband, Clint East, and children, Scarlett and Mason. It is difficult to juggle all of life: work, school, and family. I have seen the many sacrifices you have all made to get me to this point, and am blessed to have the three of you to come home to each night. Your support and love has made this possible. I look forward to celebrating all of our family's future accomplishments together.

Finally, I am grateful to God, for blessing me with such wonderful support and love to reach this milestone.

ABSTRACT

This qualitative, exploratory, single case study of one Medical Laboratory Science (MLS) academic program sought to better understand how members actively engaged and transacted with their disciplinary readings. Using purposeful sampling, eleven members of the MLS disciplinary community (faculty professionals, ascending professionals, and college students) helped to explore the two questions: (a) how do MLS college students, MLS ascending professionals, and MLS faculty professionals co-construct disciplinary literacy knowledge informed by Collaborative Retrospective Miscue Analysis (CRMA)?; (b) how does CRMA between disciplinary faculty professionals, ascending professionals, and college students inform the development of college readers' disciplinary literacy knowledge? I used Miscue Analysis and data analysis for coding and theming of data sources to look for patterns and to support developing themes. This study provides empirical evidence of how disciplinary literacy practices are enacted in the MLS discipline. This study found CRMA to be a powerful tool toward creating a sense of community in the college disciplinary setting. College student's self-confidence in their MLS disciplinary literacy practices grew and they felt more connected to their disciplinary community. CRMA allowed MLS community members to co-construct disciplinary literacy knowledge through their creation of a safe learning space. CRMA in this study made implicit disciplinary literacy practices explicit to better support college student development and co-construction of disciplinary literacy knowledge. Findings can better inform current disciplinary instructional practices and learning opportunities for college students. *Keywords*: disciplinary literacy, Medical Laboratory Science, CRMA, Miscue Analysis, college student

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CHAPTER 1
INTRODUCTION

Medical Laboratory Science (MLS) is a highly specialized discipline in healthcare, which is a blend of science and medicine. Practicing medical laboratory scientists (MLSs) may be found in research centers and reference labs, but more often in clinical settings, such as hospitals. It is in the clinical setting where they play a pivotal role in the healthcare team, providing upwards of 70-80% of the objective, or measurable, data used by clinicians for the accurate diagnosis and treatment of patients (Forsman, 2002). MLSs are also in higher education where they instruct and apprentice preprofessional students into the discipline. It is in the college setting that disciplinary texts are introduced to novice students in the discipline, and the importance of understanding how to best instruct students into the disciplinary literacy practices of an MLS becomes paramount.

The laboratory profession is a heterogenous group that includes practitioners from all higher education levels. According to the American Society for Clinical Pathology (ASCP, 2020a), these include associates-level professionals, for example, Medical Laboratory Technician (MLT), bachelor's-level professionals, for example, Medical Laboratory Scientist (MLS), as well as graduate-level professionals, for example Pathologists' Assistant (PA). Each profession has their own requirement for education and training, after which graduates may gain accreditation and, in some states, (dependent upon the profession) licensure. The American Society for Clinical Laboratory Science (ASCLS, 2012-2020a) notes MLSs have an "extensive theoretical knowledge

base…[and] evaluate/interpret results, integrate data, problem solve, consult, conduct research, and develop new test methods" (para. 2).

The specific MLS disciplinary literacy practices for the field are highly varied, inherently multimodal, and dependent upon where the MLS is practicing, for example in a clinical setting, reading procedure manuals, documenting patient laboratory values, and reading cells through a microscope are considered common literacy practices (Camillo, 2019). The major laboratory subdisciplines represented in MLS include chemistry, hematology, microbiology, and immunohematology. Other important areas of focus include laboratory management and continuing laboratory education in the discipline.

The field of laboratory medicine and the importance of clinical testing has gained notoriety, amidst the chaos that has been brought about by the COVID-19 pandemic. The ASCLS (2012-2020b) has three main groups based on level of experience for individuals to join the MLS professional organization: (a) developing professionals, college students enrolled in an accredited MLS program, (b) ascending professionals, graduates within the past five years, and (c) professionals, individuals in clinical practice or those involved in education. This study explored the co-construction of MLS disciplinary literacy practices across these three groups.

Statement of the Problem

In working with MLS college students, many of them have come to ask me how they should read the textbook and how to use it in conjunction with other course materials. The textbook is a vital component of the MLS education and being able to use it effectively eases the transition to practicing in the "real world" where professionals often still use textbooks as a reference, in addition to a variety of discipline-specific

journals (Camillo, 2019). The textbook is a gateway into MLS disciplinary reading. It provides the foundational content knowledge that is vital for the discipline, but the way it is used in the classroom provides a means for college students to understand the disciplinary reading practices used by professionals.

       The last few decades have seen an increasing awareness surrounding the various ways literacy practices are constructed and understood in the disciplines (Moje, 2007). Unfortunately, the majority of studies looking at supports for learning and reading comprehension have focused on only a few disciplines, notably history, English, science, and math (Moje, 2007; C. Shanahan et al., 2011), or have focused on adolescents (Gilles et al., 2016; Lee & Spratley, 2010). Thus, there is a need for a greater understanding into the reading practices and meaning making processes across a variety of disciplines, specifically pertaining to the college setting (Cisco, 2016; Heller, 2010/2011; Porter, 2017).

       While there is a common belief that successful college students in disciplinary courses do not need explicit reading instruction, there has become a recent, renewed interest in supporting these students (Cisco, 2016; Theriault, 2020; Theriault et al., 2019). Students in the college setting must be able to proficiently read and comprehend their complex and multimodal textbooks, and the highly specialized Medical Laboratory Science (MLS) pre-professional undergraduate program is no exception. In general, college students often struggle with how to read their disciplinary texts effectively and efficiently. Reasons for this challenge include the need to understand terminologies, concepts, and language conventions specific to the discipline, and motivation in light of

the quality, quantity, and length of readings (Boakye & Mai, 2016; Fujimoto et al., 2011;

Starcher & Proffitt, 2011; White, 2004).

The textbooks in the MLS pre-professional college setting are used to help college

students understand material covered on exams for a class, as well as for future courses,

clinical rotations, and ultimately a national certifying exam. They need to apply

information learned from one course into other settings and courses. Students need to be

able to use and understand all available resources from a course, including: lecture notes,

lab reports, textbook readings, case studies, journal articles, and homework assignments.

My interest in exploring the reading practices in the discipline stems directly from

my interactions with students. Students in our MLS program are intelligent, as evidenced

by meeting grade and GPA requirements for acceptance. Yet, even strong students will

find a learning curve associated with entrance into the MLS program as they learn to

adapt to the demands of the program. I have found myself in a position of wanting to help

guide my students in their disciplinary readings, yet struggling on how to help them.

The reading "habits of mind" (Fang & Coatoam, 2013, p. 628) of an expert MLS

need to be made explicit for novice students in preprofessional MLS programs, so as to

guide their enculturation into the discipline. As novices, these college students will have

the greatest gains if their learning is mediated by "guidance or in collaboration with more

capable peers" (Vygotsky, 1978, p. 86). Teachers tend to be viewed hierarchically above

a student (Meyer & Whitmore, 2021). By changing the perception of a teachers' position

to be someone who is beside the student, reduces the power differential and "affords the

opportunity to see, notice, ask questions, work to understand, plan for what is next, and

examine and explore differences over time" (Meyer & Whitmore, 2021, p. 5). One such

way of repositioning the teacher to sit beside the student is through Collaborative

Retrospective Miscue Analysis. Miscue Analysis, or the study of unexpected oral

responses to a written text, is one method to help educators better understand the reading

process. Retrospective Miscue Analysis, when done in a group setting, called

Collaborative Retrospective Miscue Analysis (CRMA), enables peers and teachers to

work together to better understand teachers, students, and ascending professional's

disciplinary reading moves (Costello, 1992) and can be used to help guide instruction on

reading (Murphy, 1999).

Through collaboration, the tacit knowledge of experts is made visible to novices,

at the same time novices are able to compare expert reflections on text with their own

reflections to have tangible evidence of their development in the discipline. MLS

educators will be better positioned to help college students leverage their texts more

efficiently and effectively, as well as connect their schooling to future careers and place

in the MLS profession, given a better understanding of the disciplinary reading practices

of MLS community members. A reflective understanding of how members of the MLS

discipline read will also ease the transition into the workforce for ascending professionals

and better equip them to meet the demands of reading in the discipline. To better

understand how members of one MLS community actively engaged and transacted with

their disciplinary readings to guide the teaching and learning of disciplinary reading, I

investigated the following research questions:

1. How do MLS college students, MLS ascending professionals, and MLS

    faculty professionals co-construct disciplinary literacy knowledge informed

    by Collaborative Retrospective Miscue Analysis (CRMA)?

2. How does CRMA between disciplinary faculty professionals, ascending

professionals, and college students inform the development of college readers'

disciplinary literacy knowledge?

Significance of the Study

A goal of this study was to help inform the disciplinary reading curriculum for the

Medical Laboratory Science program under study and to provide insights and potential

guidance for other programs and faculty of MLS. This study has relevance not only to the

MLS profession, but for MLS educators and their MLS preprofessional college students.

This study sheds light on how members of one MLS community transacted with various

disciplinary texts, and how their group interactions fostered the co-construction of

disciplinary literacy knowledge. This study demonstrates how CRMA can be a powerful

instructional tool that is relevant in the college, disciplinary setting.

Participation in a collaborative effort highlights the importance of the disciplinary

community to which students are working to join. Collaboration between experts and

students, as well as peer-to-peer interactions, enhance learning (Vygotsky, 1978). This

study contributes to a continual understanding of the reading process. This study explores

how college readers can become consciously aware of the control they have in the

reading process and provide tangible evidence of the disciplinary strategic moves they are

currently making (Y. Goodman et al., 2014). This study helps college students to gain

self-confidence in their ability to understand complex, disciplinary texts. The

retrospective miscue analysis procedure actively involves students in a process of

metacognition and provides an avenue for both the student and teacher to revalue the

reader (Y. Goodman et al., 2014). This study provides insight into the usage of CRMA in adult/college learners.

Post-secondary teachers often acknowledge students are not engaging effectively or purposefully with textbooks (French et al., 2015). This study presents empirical findings to illuminate how college students in one MLS program engaged with their texts. Findings can be used to inform curriculum to better provide structured practice and guided reading support for college student in the MLS discipline that leverage their current disciplinary knowledge (East et al., in press). At the same time, teachers have an increased cognizance of the hard work of their students at making meaning (Duckett, 2003). This study thus has relevance to those teaching in post-secondary disciplinary settings. College students need continual guidance in the reading process at the college level (Theriault et al., 2019) and results from this study can inform educators on how to facilitate their students on approaching a disciplinary text from a strength-based perspective.

This study also has relevance to ascending professionals and even more experienced professionals in the MLS discipline. As recent graduates, ascending professionals are the bridge between college student and professional. This study can help educators to better understand where the gaps are in the teaching of disciplinary literacy practices to better meet the needs of ascending professionals. A better understanding of the disciplinary reading practices will thus have a strong practical component for those already involved in the MLS profession, even those more experienced professionals. Similar to students, ascending professionals can also gain

validation of their hard work in the disciplinary reading process and see themselves as important contributors to the MLS community.

This study can expand our current knowledge about the disciplinary reading practices of college students. Ultimately, this study helps to expand our knowledge about disciplinary reading, the reading process, and how best to support students in their enculturation into a disciplinary community.

Researcher Background

I have always had a passion for science and was intrigued by medicine. These fields were of interest to me as I felt I could continually learn from them; both fields are ever-growing and changing. When I discovered the MLS profession, I knew it was the perfect fit to combine these two interests. As a scientist, I found I would approach tasks with an inherently positivistic perspective, of seeking to explain a single reality, to find truth as it is discovered through data analysis (Check & Schutt, 2012; Hesse-Biber, 2017).

My parents encouraged my love of reading and learning, always attending various school functions while I was in both high school and college, both undergraduate and graduate. They continue to encourage and support my passion of continual learning. Having grown up in such a supportive environment of education and learning as well as personal development and growth, I too, hope to bring this comprehensive outlook towards my mentorship of college learners in the MLS discipline.

Prior to becoming an instructor in the MLS program, I worked clinically as an MLS in an HIV specialty lab and then in an automated chemistry lab. I am a certified MLS myself and completed the same program in which I currently teach. I worked in the

hospital setting upon graduation, before going on to graduate school to become a

Physician Assistant. I thus have also worked on the patient side, as a physician assistant,

where I would encounter lab results and must act on them. With this additional

background, I can provide a unique perspective and experience to my students that my

colleagues cannot. I am thus not an expert practitioner from the perspective of performing

decades of clinical benchwork, but I do have the additional clinical knowledge and

experience, and thus am seen as an expert in the field.

      While practicing medicine, I began working as an adjunct faculty member at

Mascar University. I spent much of the time with my patients educating them about their

healthcare, and I found myself thoroughly enjoying teaching. This was a prime motivator

for me to transition to the university in a full-time capacity. I currently continue to

practice medicine in an urgent care setting, albeit on a part-time basis. My focus now is

on helping to guide my students in their development in the MLS profession. I took my

own bias, in wanting to see my students succeed, into consideration throughout data

collection and analysis to accurately reflect findings.

      I frequently use my experiences both professionally and personally as exemplars

for my students. I try to make all my students feel included, cared for, and supported as

they move through our program. My students hear daily about my own struggles as a

student myself, especially in trying to balance work, school, and family. Almost daily

there is a story about getting my children ready for school that day.

      My approach to this study and subsequent analysis is one grounded in personal

experience and a desire to understand how best to help my students. With these ideas in

mind, I approached my study reflectively, to ensure an honest representation of how

current MLS members actively transact with various disciplinary texts and thus how the

CRMA process can inform the co-construction of MLS disciplinary literacy knowledge

and the development of college students disciplinary literacy learning.

Definition of Key Terms

The following list defines key terms used throughout this study.

Medical Laboratory Scientist (MLS) – a professional in healthcare whose focus is on

laboratory science and information (ASCLS, 2012-2020a). Though the use of

sophisticated instrumentation and biomedical technology, scientists "perform

laboratory testing on blood and body fluids" (ASCLS, 2012-2020a, para.1) which

is subsequently analyzed and conveyed to physicians (ASCP, 2020b). MLS may

also be called Medical Technologist (MT) and Clinical Laboratory Scientist

(CLS).

Faculty Professional – those MLS professionals who are "certified or engaged in the

practice and/or education process" (ASCLS, 2012-2020b, para 2) of MLS's. They

have at least five years of experience in the MLS field. I specify "Faculty" to

highlight these experts are faculty members at the University.

Ascending Professional – MLS professionals who are in their first five years after

graduation from an accredited program of laboratory study (ASCLS, 2012-

2020b).

College Student – a preprofessional MLS college student enrolled in an accredited

program of laboratory study. The ASCLS (2012-2020b) classifies these college

students as Developing Professionals. I will be using the term college student to

highlight the fact these individuals are both developing in the profession but still

completing other requirements to obtain a college degree.

Disciplinary Literacy - the foundation of literacy skills and disciplinary content, while

engaged in the social and cognitive practices that make a discipline (Fang &

Coatoam, 2013). Each discipline is unique and approaches toward understanding

the literacy practices for a discipline are subsequently based upon the social

aspect of that particular discipline (Moje, 2007) and the inherent practices of

experts in the field (Chauvin & Theodore, 2015).

Procedure Manuals – a specific type of disciplinary reading for an MLS professional.

Procedure manuals are disciplinary texts that are written by MLS professionals

outlining the steps necessary to complete each procedure in a laboratory. They

also include important information about the test such as they type of specimen

required and any possible interferences.

Miscue – a term that identifies where an oral reader has an unexpected response that is

different from the expected print text, the word "error" is purposefully avoided

(Y. Goodman & Goodman, 2013).

Miscue Analysis – the study, or analysis, of unexpected responses, providing a "thick

description" of the reading process (Y. Goodman & Goodman, 2013, p. 15).

Reading Miscue Inventory (RMI) – is a tool used to analyze miscues by both teachers and

researchers (Y. Goodman et al., 2005).

Retrospective Miscue Analysis (RMA) – is a flexible, reader-centered, collaborative

dialogue about the reading process done after an oral reading (Y. Goodman et al.,

2014). It is both an assessment technique and a teaching strategy that

demonstrates reader strengths (high-quality miscues) while also revealing areas of

need (low-quality miscues).

Collaborative Retrospective Miscue Analysis (CRMA) – a variation of the RMA that

"involves small groups of students collaboratively analyzing…recorded

reading[s]" (Wang & Zheng, 2017, p. 2). Readers reflect upon miscues made

during a previous reading of a text (Costello, 1992). This study purposefully

harnessed the collaborative efforts between varying levels of expertise using

mixed groups of college students, ascending professionals, and expert

professionals.

Eye Movement Miscue Analysis (EMMA) – is a further variation of miscue analysis that

incorporates the additional usage of eye movement tracking during an oral

reading (Brown et al., 2012; Liwanag et al., 2017). The addition of eye movement

tracking enables measurement of readers' processing, such as eye fixations, or

where the eye pauses, provide key insights into reader strategies to support

meaning construction (Liwanag et al., 2017).

CHAPTER 2

REVIEW OF THE LITERATURE

My own interest in exploring how disciplinary literacy practices are enacted in the college setting has led me to the field of Miscue Analysis (MA). After reviewing the extant literature on these topics, I focused on empirical studies in both disciplinary literacy and Miscue Analysis which help educators understand how each contributes in elucidating the needs of college and adult learners. I also drew upon theoretical and practitioner pieces to further define each field and demonstrate how researchers use them. I first explore disciplinary literacy in the college and adult learner context, then turn toward our current understanding of Miscue Analysis research as it applies to college and adult learners.

To conduct this literature review, I searched multiple interdisciplinary databases (Academic Search Ultimate, ERIC, Education Source, PsychINFO, and JSTOR) for dissertations, professional journal articles, and books. I used Boolean operators and/or to search the following terms *disciplinary literacy, disciplinary comprehension, comprehension, reading, reading process, construction of knowledge, science reading research, college students, adult learners, Miscue Analysis research, miscue research, Collaborative Retrospective Miscue Analysis, CRMA, Eye Movement Miscue Analysis* and *EMMA*. I also reviewed relevant journals in the field of college learners *Journal of Adolescent and Adult Literacy*, and the *Journal of College Reading and Learning*, and consulted the reference lists of various authors in order to ensure I was not missing literature that may have been excluded from my search process. A synthesis of the literature demonstrated the need for studies on the disciplinary literacy practices of

college and adult learners as well as the applicability to utilizing Miscue Analysis to

increase our understanding of the reading process for this population.

Disciplinary Literacy Research Implemented in the College and Adult Learner Context

I aligned with the view of literacy as being a set of socially constructed (Tracey &

Morrow, 2017) practices that both occur within, and are linked, to the social, cultural, and

ideological contexts (Street, 1995) which shape them. These literacy practices are best

understood through the multiple interpretations of the members in which these shared

practices occur (Gee, 2004). Moje (2007) has found many researchers attempt to separate

literacy as being either cognitive processes or cultural practices, but she believes these to

be blended and in support of "the sociocultural perspective that cognition is culturally

mediated" (p. 13).

I used Moje's (2007) idea of literacy as a blend of the cognitive and cultural

practices as a lens to consider the model of reading described by Ruddell et al. (2019).

They position the reader at the center of meaning construction, and describe how the

reader, the teacher, and the text, actively work together to create comprehension, which is

embedded in the social context of the classroom. Following a literacy event, more

specifically reading, meaning is created through a social construction of knowledge – a

shared understanding, and learning is thus mediated based on the social context

(Vygotsky, 1978). Alvermann and Moje (2019) further this concept with a focus on

literacy instruction in what they call the ALT model (a model of adolescent literacy

teaching). Their model expands the concept of the importance of the social context in

which learning occurs while keeping a focus on the interaction between the reader, the

text, and the teacher at the center. The importance of the social context in the

construction of knowledge is made evident by this model as "the model situates reading

inside particular disciplinary discourses, practices, knowledge domains, text, and tools"

(p. 377). So, while every teacher may be a teacher of reading, they contend the way this

will manifest is inherently going to be an everchanging and ever evolving phenomenon.

Every student, teacher, and textual transaction is unique and based upon the context in

which they are occurring.

Lea and Street (2006) have conceptualized literacy learning within the academic

contexts in which they occur, and support a model of learning that incorporates three

overlapping models: study skills, academic socialization, and academic literacies. These

allow for a "complex, dynamic, nuanced, [and] situated" approach to literacy that

foregrounds the social processes of a particular discipline (Lea & Street, 2006, p. 369).

Members must be able to use and understand the languages of a discipline in order to be

socialized into that particular community. Gee (2004) differentiates home language from

language that is dependent upon a particular social context, which he calls "social

languages" (p. 14). In the context of school, these social languages may be termed

academic languages. He further breaks academic social languages down to explicate they

do not necessarily follow "whole disciplines but…sometimes subdomains of a discipline"

and adds they are often learned through engagement in practice as opposed to explicit

instruction (Gee, 2004, p. 15). Gee continues "when people learn new social languages

and genres…they are being socialized into…Discourses with a big 'D'" (Gee, 2013, p.

143). These Discourses are learned outside the home. He bases his interpretation of

Discourses off of other theorists, for example, Wenger's (1998) communities of practice,

where literacy practices are meaningful because they are situated in social contexts. The idea of Discourses thus lends itself to understanding the concept of disciplinary literacy, which is more than just reading and writing in a discipline, but also participation in the various "communicative practices" (Airey, 2011, p. 3) of a discipline.

Construction of Knowledge

Drawing from Gee's (2013) idea of Discourse communities, Porter's (2018) work creates a deeper understanding about literacy practices within a few disciplinary communities: accounting, biology, political science, and secondary education. In her work, Porter (2018) constructed a compelling description of how various disciplinary communities are dynamically co-constructed between students (disciplinary novices), professors (disciplinary experts), and practicing professionals (practitioner experts) in the college setting. She found discrete differences in how the disciplines approached literacy, based on their sociocognitive praxis, for example biologists were "critical consumers and producers of knowledge" (p. vii). Her work supports our understanding of college disciplinary learning as a form of apprenticeship best learned through immersion and active participation, not solely a "static reproduction of disciplinary epistemological traditions" (p.220). It is in the undergraduate disciplinary context where students were seen as transitioning towards membership of a disciplinary community. Experts in her study acknowledged it was in the college setting, often with explicit scaffolding from experienced mentors, when they themselves developed in their disciplines. The disciplinary experts in her study admittedly struggled with how to incorporate literacy practices further into their own curriculum, but they all strived to create authentic experiences in their respective disciplines.

Porter (2018) calls for a greater understanding of the literacy practices in more disciplines in the college setting, with an inclusion of the "literacies-in-use" (p. 218) of practicing professionals, as well as college students' transition from disciplinary novice to disciplinary community members. She recommends disciplinary educators evaluate their current curriculum for relevance to the real-world practices of the discipline, while acknowledging the need of support for educators to accomplish this. Her work makes apparent the complexities involved with understanding each discipline's literacy practices, while acknowledging these practices as fluid and inherently situated with the sociohistorical contexts they occur.

Disciplinary Literacy Theoretical Foundation

The last few decades have shown an increasing interest in the literature in describing disciplinary literacy practices (Moje, 2007). The corpus of research affirms the idea of disciplinary literacy as a perspective for guiding inquiry among various content areas. Thus, disciplinary literacy is distinct but complementary to content area literacies, which acknowledges C. Shanahan's (2009) characterization of the two as being parallel structures that dynamically interact: disciplinary knowledge considers both the what and who counts, while content knowledge is imperative to understanding the subject matter itself.

Disciplinary literacy includes the foundation of developing disciplinary knowledge and content in combination with the social and cognitive practices that make up the habits of mind of a discipline (Fang & Coatoam, 2013). T. Shanahan and Shanahan (2012) further differentiate content area literacy from disciplinary literacy by emphasizing "knowledge and abilities possessed by those who create, communicate, and

use knowledge within the disciplines" (p. 8). These perspectives highlight the social

aspects of the discipline as well (Moje, 2007). Put simply, content area literacy is seen as

a standard set of skills that may be applied in any of the content areas (science, history,

etc.), while disciplinary literacy highlights each discipline as unique and every literacy

event should be approached through the individual differences the discipline brings.

Disciplinary Reading

A main point of difference I would like to highlight is how the two approach

reading tasks. Content area literacy focuses on bringing generalizable literacy strategies

and knowledge into the discipline - an outsider approach, while disciplinary literacy

focuses on starting within the discipline and the practices inherently used by experts in

the field, and then adapting literacy practices to support learning - an insider approach

(Chauvin & Theodore, 2015). Moje (2015) views the idea of content areas as distinct

from a discipline due to the inherent consideration of the social setting in which they

occur. Knowledge in a discipline is unable to be reduced to "skills-based literacy teaching

that is abstracted from purpose and value" (Moje, 2015, p. 255). These ideas are an

important basis for considering disciplinary knowledge itself.

Thus, disciplinary literacy is not solely memorization of facts, rather students

need a solid foundation of literacy skills and disciplinary content to understand concepts

and apply them toward new settings, all while engaged in the social and cognitive

practices that make a discipline (Fang & Coatoam, 2013). Fang and Coatoam (2013)

acknowledge much of the research on disciplinary literacy has largely "remained

conceptual, either making a case for why a disciplinary perspective is needed or

describing ways disciplines differ in content, epistemology, language use, and habits of

mind" (p. 629). Moje (2007) on the other hand would argue there are many empirical

studies available surrounding disciplinary literacy, but they must be viewed in terms of

their relevance. This is an important distinction; we have limited empirical studies to

evaluate how disciplinary literacy is enacted in discrete disciplines. First, I discuss our

current understandings surrounding disciplinary literacy from the perspective of these

literacy practices occurring in a disciplinary community. It is out of the purview of this

review to fully explicate all the disciplinary literacy practices from every discipline and

across all ages. The following section focuses on the disciplinary reading practices

related to science in the college and adult setting.

Disciplinary Reading Studies with Experts in the Science Disciplines

Much of the empirical grounding on the argument for disciplinary literacy has

come from studies looking at expert readers (for example, Bazerman, 1985; Chapman,

2015; C. Shanahan et al., 2011). It is important to study the processes of disciplinary

literacy as they are enacted by disciplinary experts, to allow a better understanding of the

nuances of practice in the discipline. If we acknowledge each discipline has a discrete

way of utilizing Discourse (Gee, 2013) and creating meaning, then in order to understand

that particular discipline, we must study how members are actually participating in the

literacy practices (Porter, 2018). Expert studies on disciplinary reading have expanded

our knowledge on important characteristics used in the disciplines under study.

I limit the discussion of studies with expert readers – those readers seen as highly

proficient in their field – to include those in science. First, I discuss work done by

Bazerman (1985) with physicists, before turning to more recent work done with chemists

by C. Shanahan et al. (2011), and Chapman's (2015) work, also with physicists. A pivotal

early study by Bazerman (1985) considered how physicists read. He found that comprehension of reading was not only a social act but the reader's purpose was heavily intertwined with their schema. If the physicist felt the reading was relevant to their work, they adjusted how they read, ensuring comprehension and often critiquing; if the reading was not as pertinent to their interests, they would change their stance and critique less. These physicists understood their readings were coming from other members of their discipline and would acknowledge the shared communication that was occurring. This study opened the door to start thinking about how members of various disciplines approach reading, important considerations when reading, and the stance with which they approached the text, but also how they gain meaning from it.

In an attempt to identify specialized characteristics of disciplinary reading, C. Shanahan et al. (2011) analyzed how experts in history, chemistry, and math read. They found readers in various disciplines not only had discrete reasons for reading but also the way that they were reading differed based on their particular discipline. Specifically related to chemistry, they found that scientists would contextualize their readings, often this was due to the rapidly changing nature of science in general, and they would evaluate the source of information. Scientists also viewed graphic elements as an alternate source of information that was often necessary for understanding. Similar to Bazerman (1985), if the text was outside of their specialty, they would suspend their critique. C. Shanahan et al. (2011) encourage further studies looking at additional disciplines and felt their main themes identified in disciplinary reading processes: sourcing, contextualization, corroboration, text structure, graphic elements, and critique, could be utilized across any discipline to highlight nuances between disciplines.

The recent case study by Chapman (2015) provides greater detail into the social, semiotic, and cognitive disciplinary practices of three experts: an engineer, a literary expert, and a physicist. The physicist noted how books were great for foundational knowledge, but to keep up with current research he stressed the necessity of journal articles. Texts chosen by the physicist were those of relevance to his specific field, he used sourcing to determine credibility, and kept a specific purpose in mind for any reading. The importance of multimodal representations was stressed "data is the most important communicative tool used within the laboratory" (p. 140). Chapman's work provides a more in-depth look into the social and semiotic nature of physicists' disciplinary practices.

These seminal works were important in setting the stage for studying disciplinary reading practices. They argue there are nuanced differences amongst sub-disciplines, which are important to not only characterize the practices within these disciplines, but also to study the processes which undergird how novices in disciplines develop their understanding of and become encultured into a discipline. A resounding cry across the corpus of literature remains for studies to explore the construction of knowledge in more disciplines and to understand the relationship between expert and novice.

Disciplinary Reading Practices in Science

Reading in science can be many different things depending on the content or field being read, so that what "counts" as reading is often discipline-specific (Camillo, 2019; Eriksson, 2019; C. Shanahan, 2009; T. Shanahan & Shanahan, 2008; Soliman & Fouda, 2009; White, 2004; Wilson, 2011). Smagorinsky (2001) defines texts broadly as "any configuration of signs that provide a potential for meaning" (p. 137). This permits us to

view text as being more than just alphabetic text, but accounts for the implicit

multimodality that is common to many disciplines, especially the sciences (Lemke,

1998). Each discipline is unique in the literacy practices and disciplinary reading, in

which members engage. The literacy events are embedded within the social structure in

which they occur. A disciplinary Discourse integrates ways of "talking, listening, writing,

reading, acting, interacting, believing, valuing, and feeling…in the service of enacting

meaningful socially situated identities and activities" (Gee, 2013, p. 143). Reading in

science is thus not exclusively text based, rather the importance of reading multiple

semiotic representations is critical to comprehension (Kress & van Leeuwen, 2006;

Lemke, 1990, 1998); where alternative forms of presenting information are not repetitive

but necessary for "integration and cross-contextualization among semiotic modalities"

(Lemke, 2004).

   Eriksson (2019) makes a compelling argument for astronomy students to read the

sky, acknowledging students need the disciplinary content knowledge, but also must

"'read' all the different highly specialized disciplinary-specific semiotic resources that

astronomers use to communicate within the discipline" (p. 1). This particular perspective

is rather unique to science, where many phenomena are unable to be seen with the naked

eye and require multiple semiotic aides.

   Camillo's (2019) seminal work evaluating the disciplinary practices of Medical

Laboratory Science (MLS) adds to this idea. Camillo (2019) helped to define the

disciplinary literacy practices (including written communication, reading practices, and

oral communication) and the professional identity of the MLS profession. Focusing on

the reading, she looked at the *why* and *what* an expert MLS would read. Based upon

multiple surveys utilizing the classic Delphi method, Camillo (2019) found that the three

main reasons MLS professionals read were to "stay informed, for evaluation and action,

and…[to] read multiple systems that do not require written word (semiotics)" (p.13).

Ultimately, she found MLSs read for specific purposes: to solve a problem, stay up to

date on current testing or procedures, learn new technologies, or even for teaching

purposes.

The *what* an MLS reads is more varied and depends on both the professionals'

subdiscipline (for example, chemistry or hematology), their position (for example, bench

technologist or supervisor), and their motivation (for example, their own continuing

education or to understand a procedure manual). She additionally noted disciplinary

reading required multiple semiotic systems: numbers or numerical values, graphical

representations, images, validating results, and most importantly "reading patient

results…color changes, agglutination, colony formation and growth patterns on agar, cell

morphology, stain results, etc." (p. 86). Reading for MLS was not simply decoding words

on a page, but involved integrating the language cueing systems with the multiple

semiotic forms of written, visual, and oral communication. Camillo's (2019) study has

brought light to the disciplinary literacy practices (including the reading, writing and oral

communication) of the MLS profession.

Disciplinary Reading Practices by College Students

The inherent practices of the discipline must be made evident for college students

to learn not just disciplinary content, but the habits of mind of a discipline. Students do

not readily have the "intuitive judgement, 'the feel'" of a disciplines' literacy practices

(Chase et al., 1994, p. 16). The specific disciplinary literacy practices are highly

dependent upon the discipline, and expert readers in the disciplines differ in "how they perceived their texts as challenging and in the way they approached the texts" (C. Shanahan, 2009, p. 244). Many of these differences are not made explicit and thus students have difficulty in approaching these disciplinary texts.

In general, science texts are written with an authoritative stance meant to suppress agency (Snow, 2010), with increased lexical density and a high number of content words that are often very technical terms (Fang, 2004), and contain a host of multimodal features (Lemke, 1998). C. Shanahan (2009) acknowledges experts take these factors into consideration when approaching a text and implores disciplinary instruction to include disciplinary reading as "embedded in the practices of every discipline" (p. 257).

Many empirical studies looking at college students reading have focused on outcomes, for example, testing to see if a student has achieved comprehension of a topic (Linderholm et al., 2014; Ozuru et al., 2008) or strategy usage (Kolikant et al., 2006; Pergams et al., 2018; Theriault et al., 2019). Theriault et al. (2019) argue for continued strategy instruction and add literacy development should continue at the college level "due to the various high-level, sophisticated, and highly specialized disciplinary and professional literacy tasks with which students are confronted" (p. 547). But empirical research on the process of comprehending these students engaged with during a reading event is scarce.

There are many studies looking into developmental reading by college students, but, unfortunately, this is not the case with proficient college readers. There are limited empirical studies addressing the important issue of how students transition from novices toward disciplinary readers (Porter, 2017).

A seminal empirical study looking at disciplinary reading development in college was done by Haas (1994), where she followed one biology major throughout four years of undergraduate coursework. In this longitudinal study she was able to demonstrate how this individual reader was transitioning into a member of her desired disciplinary community using characteristics recognized in Bazerman's (1985) study of physicists. As a freshman, she identified texts as being authoritative and not connected to an author, something she needed to memorize for class and often used her highlighter extensively. By the time she was a junior, though, she began to use more disciplinary practices: "skimming, reading selectively, moving back and forth through text, reading for different purposes at different times" (Haas, 1994, p. 64). These practices continued to grow and as a senior she had developed an increasing awareness to disciplinary specific context and necessity of multimodal characteristics. Haas provided an explanation for this student's progression towards the disciplinary practices of a biologist: increased content knowledge, various instructional supports, "natural" development, and mentoring in a sociocultural setting.

Sociopsycholinguistic Transactional Reading Model

Reading is a dynamic, meaning-making language process occurring as a transaction between the reader and the text (Y. Goodman & Goodman, 2013), and this process may be explored from the moment the eye first views the page through final comprehension of what was read (Samuels & Kamil, 1998). Readers do not read every word of text, but rather approach a text in an effort to comprehend it as a whole (K. Goodman et al., 2016). With a view that the goal of reading is comprehension, considering the reading process as a set of steps to attain comprehension does not fit.

Reading must start with authentic, appropriate materials and occur in a natural setting. The idea of whole language thus developed, viewing reading as a non-linear and dynamic process with a focus on making sense of whole, authentic texts which places value on both the learner and the teacher (K. Goodman & Goodman, 2009).

Kenneth Goodman's (1998) pioneering work in this field has helped to construct a "model of the reading process powerful enough to explain and predict reading behavior and sound enough to be a base on which to build and examine the effectiveness of reading instruction" (p.11). This led to the Goodman model of the reading process: a transactional sociopsycholinguistic process (Y. Goodman & Goodman, 2013). Consideration of the *process* of reading as its own distinct category when discussing reading, allows for study into the nuances that occur while a reader is transacting with a text towards constructing meaning. Those processes that occur during the reading of a text provide insight into a reader's comprehending. Further, acknowledging a difference between comprehending and comprehension, or the reader's understanding at the end of a text, allows us to study comprehending as its own entity (Y. Goodman et al., 2005). It is essential for researchers to strive to paint a more complete picture of the reading process, especially in the disciplines, as this ultimately helps us to gain understanding of our readers' meaning-making processes. The transactional sociopsycholinguistic process (Y. Goodman & Goodman, 2013) provides an overview of the theoretical constructs of reading from which miscue research is based.

Framework of Miscue Analysis

The way to study the *how* of reading can vary, but requires an understanding surrounding the reading process. An effective way to explore how readers both

comprehend text and reveal comprehending in process is through Miscue Analysis (Y. Goodman & Goodman, 2013). There are various forms of Miscue Analysis that may be conducted, on an individual level between the teacher and the student (Y. Goodman et al., 2014), in a group setting between a reader and a small group of peers guided by a teacher (Costello, 1992), or by the additional tracking of eye movements during an oral reading (Liwanag et al., 2017). Miscue Analysis has been found to be a valid and reliable way to assess the reading process and understand diverse readers' meaning making processes, while providing key insights that may be used to guide instruction on reading (Murphy, 1999).

The term miscue is used to identify where an oral reader has an unexpected response that deviates from the expected text, the word "error" is purposefully avoided, as these imperfections are seen as an asset (Y. Goodman & Goodman, 2013). Miscues are found to occur due to a reader's linguistic or conceptual cognitive structures and reading strategies they bring to the literacy event. Goodman et al. (2014) stress "*all readers make miscues*…miscues are inherent for readers of *all proficiencies*. We emphasize this because miscues are necessary for comprehension; they are part of the reading process" (p. 6, emphasis in original). A miscue is not a random occurrence, rather it is based on the transaction taking place between the reader and the text (K. Goodman, 2008). Miscues provide insights into how a reader is processing a written text (Y. Goodman & Goodman, 2013). The analysis of these alternative productions enables a teacher to determine a reader's strengths and weakness, and provides a means to tailor instruction to the student (Y. Goodman et al., 2005).

By asking readers to read aloud, observed and expected responses may be analyzed, enabling insight into the reader's processing strategies and their competence. A typescript of the reading is used to record miscue markings as a way "of recreating the reader's reading", including all observable responses to the text, even pauses and intonations (Murphy, 1999, p. 101). The markings are subsequently coded utilizing the reader's language cuing systems and strategies while transacting with the text. Miscue Analysis, or the analysis of unexpected responses (Y. Goodman & Goodman, 2013), is a vital tool to examine the comprehending process occurring in a reader and enables the individualization of future curriculum to be developed that is tailored to where and how a reader is struggling (Doyle, 2013). By observing a reader during an oral reading session, even on a single occasion, there is a rich data set that is able to be produced; Miscue Analysis thus provides a "*thick description*" of the reading process (K. Goodman, 2008, p. 15).

Miscue research provides both qualitative and quantitative information on the reading process (K. Goodman et al., 2017). Initially, miscues were approached from a linguistic perspective, but as further understanding grew around the nature of reading, this view grew to include the pscycholinguistics (K. Goodman, 1969) and later, as the importance of the social and cultural aspects of reading were made apparent, sociopscycholinguistic process (Y. Goodman & Goodman, 2013) Miscue research has continued to develop over the last half a century to empirically study readers of all ages and abilities using a variety of formats, for example, Retrospective Miscue Analysis (RMA; Marek, 1987), Collaborative Retrospective Miscue Analysis (CRMA, Costello, 1992), and more recently Eye Movement Miscue Analysis (EMMA; Paulson, 2002).

Miscue Analysis Research Implemented in the College and Adult Learner Context

The Reading Miscue Inventory (RMI; Y. Goodman et al., 2005) has been used for years as a way to analyze miscues by both teachers and researchers. Miscue research flexibility enables its application to numerous settings with practical implications which are of interest to multiple parties, not just teachers. Often, the researchers using Miscue Analysis are teachers themselves, looking at how best to serve their students, but the potential is vast (Y. Goodman, 1996). While Miscue Analysis is typically done with younger children and adolescents, research into Miscue Analysis also extends into the ways future educators come to understand the process.

Miscue Analysis research does not solely focus on the end product, but may also evaluate the process of learning how to do it (Wohlwend, 2012; Gilles, Johnson, & Osborne, 2020). Research into the process of using Miscue Analysis makes apparent the multitude of ways it can inform the teaching of reading. Wohlwend (2012) presents her own work on using spider charts in the college classroom to help preservice educators see the connections between Miscue Analysis findings and the three language cuing systems. She found many preservice teachers were missing the extent that Miscue Analysis can be used to guide further instruction. By creating a spider chart, also called a radar chart in Excel, preservice educators were able to visualize how the combination of a first-grade reader's miscues were actually "pointing to the reader's system of choice for decoding words" (p. 113). She adds this manner is beneficial for pre-service teachers to gain experience in evaluating Miscue Analysis to further recommend teaching strategies to benefit the reader, for example, recommending meaning-oriented instruction when a reader is focusing on the graphophonic language cuing system. This practitioner research

helps to extend educators' understanding about teaching the miscue process and the importance of how best to use it as a method to guide reading instruction.

Retrospective Miscue Analysis (RMA)

Retrospective Miscue Analysis (RMA; Marek, 1987) was developed from Miscue Analysis as a way to engage readers in a collaborative dialogue about their reading process (Y. Goodman et al., 2014), using information collected from the RMI (Y. Goodman et al., 2005). RMA makes apparent each reader's strengths by demonstrating high quality miscues they make while reinforcing the idea "that proficient reading is not free of miscues" (Y. Goodman et al., 2005, p. 205). Readers become more aware of the multiple strategies they use during reading and gain insight into the control they have over the reading process. They learn the focus is on reading for meaning not to "struggle for accuracy" (Y. Goodman et al., 2005, p. 205). Readers in turn revalue their reading process and more importantly themselves as readers and learners, while at the same time, teachers or researchers are able to revalue the hard work of the reader (Y. Goodman et al., 2014). RMA has been shown to be effective in helping proficient readers in addition to developing readers, and may be used in a variety of contexts, including with college and adult readers (Theurer, 2010).

Marek (1987) argued for the validity of RMA as a tool to be used with adult readers, not just children. She worked with two college readers and through RMA helped them to revalue their hard work at making meaning when reading and helped them to see their reading habits in a new light. While her work focused on two college readers who had contacted a remedial reading center for assistance, she extends our thinking about RMA to become a powerful strategy to evaluate how adult readers in general are

transacting with text. Her initial thought of language learning being presented "in 'wholes' complete with beginnings, middles, and ends, and existing from some real purpose" (p. 252), rather than from a bottom-up process, was reinforced by her research. She also came to realize "only the reader is in the position to judge whether miscues disrupt meaning" (p. 255). This is a vitally important concept. If the main goal of reading is comprehension, it is up to the reader to determine if comprehension has occurred. She was able to demonstrate how she helped guide her participants to revalue their reading. She also came to the discovery of how she revalued the readers – how they helped to inform her (the researcher) of the many individual ways people go through the reading process and come to comprehend their text. This is significant when studying adult learners, where many preconceived notions about the reading process and the type of reader they are, may prohibit them from reaching their full potential. Working with college students, even ones not labelled as "struggling," researchers and educators can help them to appreciate how their disciplinary reading is contributing to their understanding of disciplinary knowledge. This is vital information for educators that strive to not only prepare students for a future career, but also to enculture them into the discipline.

Since Marek's (1987) work using RMA with college readers, more researchers have chosen to further our understanding about the reading process with adult learners. True, much work has been done with readers labeled as struggling, or those in developmental or remedial reading courses (Paulson, 2001; Paulson & Mason-Egan, 2007; Theurer, 2010). Other researchers have chosen to explore how proficient adult readers contribute to our understanding of the reading process, but often with a focus on

multilingual and second-language reading (Wang, 2019; Wurr et al., 2008/2009) or on

nonalphabetic orthographies (Al-Fahid & K. Goodman, 2008; Kim et al., 2008; Wang &

Y. Goodman, 2008). These studies with proficient readers, regardless of a second

language focus, provide many important insights into the reading process.

     Wurr et al. (2008/2009) looked at adult bilingual and multilingual second-

language (L2) learners, as this population had, at the time, not been studied in detail.

They were exploring what gains a proficient L2 reader could have through an increased

awareness of the reading process. They present a case study which looked at three adult

L2 learners, each participated in multiple RMA sessions with the researchers. They found

through participation in RMA, each of the readers developed a greater focus on meaning

construction while reading and had a greater awareness of reading strategies available to

increase text comprehension. The readers were more cognizant of their reading process

and all readers benefited from an increased confidence in their reading. This study further

demonstrated even proficient college readers make miscues, while additionally

highlighting how proficient adult readers were able benefit from the miscue process.

     Wang's (2019) study also utilized RMA in proficient adult English learners. But

Wang (2019) focused solely on two Chinese international graduate students and readings

in their selected disciplines. She found the two readers were both efficient and effective

in their usage of multiple strategies to garner meaning while reading. An interesting note

she makes is one reader's preference to read from her tablet instead of paper as "there

was no page break in the tablet application that she used, and this helped with her flow of

reading" (p. 670). Similar to Wurr et al. (2008/2009), both college readers grew in their

reading confidence, became more aware of the strategies they were utilizing when

reading, and to value meaning over accuracy when reading (Wang, 2019). Her study additionally demonstrated how these proficient readers were focusing on what new information they could learn from the texts read, to "expand meaningfulness in their disciplines" (p. 676). Wang (2019) recommends future studies using eye tracker technology while reading, to investigate the silent reading process, and encourages studies from more disciplines. It becomes apparent from studies done by Wurr et al. (2008/2009) and Wang (2019) that RMA is a valid methodological choice to study the reading process in proficient readers in addition to developing readers (Marek, 1987). There is a need to expand our understanding about how proficient readers navigate texts from a variety of disciplines.

While both Wurr et al. (2008/2009) and Wang (2019) have expanded our knowledge about proficient multilingual college readers, they were both looking at second langue reading. Fewer studies have evaluated the reading process of proficient readers in their primary language. Theurer (2011) complicates our understanding of the similarities and differences of both proficient and less than proficient readers through her comparison of the two. She found that while less than proficient readers did indeed make a greater number of miscues, the rate at which the two groups correct miscues was essentially the same. She hypothesizes multiple reasons as to why this occurred: the proficient readers produced semantically acceptable miscues that did not interfere with meaning or their reading, less than proficient readers lost meaning but kept reading, or possibly proficient readers selectively corrected to retain meaning in the text. She also found the types of miscues each group made (substitution, insertion, omission, and misarticulation) were essentially similar.

Collaborative Retrospective Miscue Analysis (CRMA)

As previously demonstrated through RMA, readers, including college students, revalue their hard work at reading comprehension, at the same time enabling them to take ownership in their contribution toward the reading process (Y. Goodman et al., 2005; Marek, 1987). By moving RMA to a group setting, participants are able to learn with and from each other on the multiplicity of ways toward coming to understand a text, in a collaborative fashion. Meaning is able to be negotiated through the social interactions which make up the Collaborative Retrospective Miscue Analysis (CRMA) session. All participants may benefit from this collaboration (Costello, 1992; Seeger, 2009). This setting lends itself to being used by all age groups and disciplines. More experienced readers can provide insights and guidance for novices on their meaning-making strategies when reading. At the same time, more proficient readers come to appreciate the hard work novices in the field are doing towards simultaneously learning difficult content material and how to effectively and efficiently read in the discipline. Novices in the discipline will have tangible evidence of the many ways to be successful in disciplinary reading, an awareness of the various strategies available to them when reading, and the freedom to strategically choose which to utilize to understand disciplinary texts.

According to Costello (1992), an initial focus of CRMA was on finding a way to bring the Retrospective Miscue Analysis process more effectively into the classroom, encouraging the social construction of knowledge where students are both "supported and facilitated by their peers" (p. 19). As a seminal researcher focusing on CRMA, her work has been foundational for future CRMA studies in various contexts. Costello (1992) worked with middle school students using CRMA over a four-week period. She sought to

discover how RMA done collaboratively could affect the reading process as well as

perceptions about the process by the young readers. To accomplish this, she completed

her research in three phases: prior to the CRMA sessions, the CRMA sessions, and then

after the CRMA sessions concluded. Costello interviewed adolescents before and after

participation in the CRMA process to determine how they both perceive the reading

process as well as their self-described reading strengths and weaknesses. She completed

Miscue Analysis both before and after the CRMA process to evaluate changes in the

students. This study examined what the CRMA sessions revealed about the reading

process when students engaged with their peers and how CRMA could be attributed to

any changes seen in the students.

Costello (1992) had the teacher participate during the final 10 minutes of each

CRMA session – the peer interactions were the primary focus – but found the role of the

teacher to be both "beneficial and crucial to the success of the sessions" (p. 289). They

helped to mediate students learning by providing necessary clarification for the students

and highlighting the strengths and weakness of the readers. She found the collaborative

RMA process to provide additional insights for the readers beyond individual RMA.

Students discovered new reading strategies and how peers were utilizing them, became

overtly aware that all readers miscue, and more importantly "learn to communicate,

mediate and negotiate in the context of the collaborative group" (p. 310). Costello

additionally found this had profound effects on these young reader's social behavior, they

could "develop tolerance and understanding for another's point of view" (p. 310), while

recognizing appropriate behaviors for a collaborative group setting. Not only did students

gain intellectual insights into the reading process, but they also grew as individuals.

Length of time for engagement with CRMA was found to be a significant limitation for Costello (1992). She recommended using CRMA as an instructional tool over the course of the school year, not just one month. She also notes the potential for using CRMA in various disciplines. Seeger (2009) took on the call with her longitudinal study of 6th graders participating in CRMA over the course of a school year. Similar to Costello (1992), Seeger (2009) found the students grew both intellectually and personally, moving from focusing on number of miscues and 'correct' readings toward discussions that focused on making sense of text and quality of both miscues and retellings, while navigating the social interaction of CRMA to support each other's learning. Seeger provides multiple suggestions for further study and encourages, among other things, the usage of CRMA with expository texts and electronic texts. While both Costello (1992) and Seeger (2009) focused on adolescents, as seen with individual RMA (Y. Goodman et al., 2014; Marek, 1987) the process lends itself towards the adult learner.

CRMA: Working with College and Adult Readers

Wang and Zheng (2017) contributed to an understanding of CRMA with college readers. Their study explored how three pairs of English learners at a college in mainland China navigated the reading process with CRMA. They found the students' awareness about the reading process increased, and "students' beliefs shifted…toward reading as meaning making" (p. 7). Although the students were proficient in their first language, when it came to English as a foreign language, they would often miscue due to vocabulary and pronunciation. The students in this study had a desire "to learn the correct pronunciation to ensure they could be understood" (p. 10). This desire to be understood was manifest in their social interactions while participating in CRMA, the students were

found to be positive and encouraging of each other's efforts and frequently would joke with each other. Ultimately, Wang and Zheng (2017) found the college students took more ownership in their role in the reading process while engaging with their peers to construct meaning from text.

MacDonald (2021) explored the reader identities of five college students with a documented reading disability using RMA, EMMA, and CRMA. She utilized a multiple case studies design to better understand how past experiences influence reader identity of college students with diagnosed reading disabilities as well as how their participation in MA and CRMA contributed to their literacy identities. She found the readers in her study had positive home experiences with literacy but mixed experiences from their K-12 schooling, both of which impacted their perceptions about their literacy identities as adults. MacDonald (2021) found when her readers engaged in Miscue Analysis their thinking about the reading process changed and they had a greater understanding of reading as meaning-making process. College students in her study also had a greater awareness of reading strategies they were using to successfully create meaning while engaged with various texts. Her study was significant in that it revealed how Miscue Analysis contributed to a revaluing of self while creating a more positive literacy identify in college students with documented reading disabilities. Specifically, her readers' participation in CRMA helped to create a sense of community and contributed to reader identity development. MacDonald's (2021) study further informs our current understanding of the reading process in the adult, college student and provides empirical evidence of the effectiveness of Miscue Analysis and CRMA in fostering ownership, agency, and self-confidence in reading ability of adult learners.

CRMA as a Pedagogical Tool

Collaborative Retrospective Miscue Analysis has become a well-documented way to foster student awareness into the reading process and build self-confidence in perceived reading proficiency. CRMA is a student-centered process and many studies (Costello, 199s; MacDonald, 2021; Seeger, 2009; Wang & Zheng, 2017) have focused on student gains and benefits. CRMA additionally can be used as an instructional tool and fewer studies have looked at how incorporating CRMA into the classroom can influence teacher pedagogy. Gilles, Johnson and Osborn (2020) better inform our understanding of the implications of CRMA in the classroom in their case study of two seventh-grade reading intervention teachers as they brought CRMA into their classrooms. Their study revealed that teacher self-confidence in holding reader conferences with students grew through their participation in CRMA. Teachers were better equipped to help students in areas they were struggling in reading by approaching them with a "strength-based approach" (p. 89). They found the teachers to be receptive to incorporating CRMA into their curriculum and flexible in adapting their lesson plans to better meet individual student need. CRMA in their classrooms was successful because both teachers created "a rich, open-ended reading culture, scaffolding for student and/or inventing pedagogy using hand-on activities, and consistently demonstrating positive, respectful language" (p. 92). They prioritized reader choice in selecting reading material and ultimately fostered a sense of respect and inclusivity in their classrooms. By turning the focus of study in CRMA from primarily the student to the instructor, Gilles, Johnson, and Osborne (2020) were able to show how teachers revalued the work of their students, were instrumental in creating a sense of community in their classrooms, and increased their repertoire of

instructional strategies for the classroom to foster student-centered learning. While this

study specifically looked at teachers in the seventh-grade classroom, these teaching

principles may be applied to the adult learner as well.

Eye Movement Miscue Analysis (EMMA)

The integration of eye movement tracking during an oral reading along with

miscue data, called Eye Movement Miscue Analysis (EMMA), enriches Miscue Analysis

by showing how a reader interacts with a text to build comprehension and demonstrates

the active nature of reading (Brown et al., 2012; Liwanag et al., 2017). During an oral

reading, it is what the brain processes and reports that is spoken, not just what the eyes

see (Y. Goodman & Goodman, 2013). Measures of readers' processing, such as eye

fixations, or where the eye pauses, provide key insights into reader strategies to support

meaning construction (Liwanag et al., 2017). Much of the EMMA research has focused

on adolescent readers; however, some notable EMMA research has focused on college

and adult readers.

EMMA Miscue Examples in College Students

As a pioneer in the field of eye movement Miscue Analysis, Paulson's (2002)

seminal work with college readers has transformed how we consider miscues through his

evaluation of eye movements during omission and substitution miscues. Contrary to the

popular belief of careless reading leading to word omissions and substitutions, he found

readers did indeed fixate on words omitted and substituted during an oral reading

(Paulson, 2002). Omitted words were often read at other points in the text, showing the

students were not leaving them out due to lack of understanding, rather they were

constructing a parallel text that made sense to them as the reader and the omission was

"the reader's response to that text item" (Paulson, 2002, p. 60). Paulson's (2002) work

extended K. Goodman and Gollasch's (1980) work on deliberate and non-deliberate

omissions, by providing further insight into what a reader was doing during an omission

through the usage of eye movement technology. K. Goodman and Gollasch (1980) found

deliberate omissions came about "as the result of internal deliberation" (p. 16) where the

reader considers alternatives and makes a conscious decision in their oral representation

of the text. Non-deliberate omissions were found to be an artifact of the reading process,

were varied in nature, and show "what such miscues are *not*" (K. Goodman & Gollasch,

1980, p. 22, emphasis in original).

Similarly, substituted words were looked at and often the readers spent more time

on these words, again demonstrating how they were transacting with the text to construct

meaning (Paulson, 2002). A notable teaching implication highlighted from this study is

the common "exhortation to the student to 'slow down and look carefully at the text'

loses its validity" (Paulson, 2002, p. 64). This concept can apply to the disciplinary

context as well, where instructors often do not focus on reading instruction, rather

focusing on teaching content knowledge. It becomes important to consider what is

happening when readers are transacting with complex multimodal science texts.

Sulaiman et al. (2020) utilized eye movement data during reading of English

academic texts by Malaysian ESL college students to explore cognitive processes. They

utilized the retelling of the text to not only demonstrate recall but determine

comprehension of the readers in combination with eye movement data, specifically

looking at fixation duration and regressions in the text. The purpose of differentiating

recall from comprehension was to try to identify patterns in the readers. Readers tended

to "read academic text in a linear manner" (Sulaiman et al., 2020, p. 71). They found

longer fixation durations in readers who failed to recall the text. This could be due to

difficulties the reader encountered while reading, such as features of the text structure as

well as new vocabulary. Similarly, those readers who understood the text as well recalled

the texts regressed more between words and lines more than readers who failed to recall

and/or understand the text, demonstrating their more effective integration of meaning

while reading. Regressions within word were found to be related to difficulties in

understanding specific vocabulary. This lack of understanding of vocabulary was tied to

their ultimate lack of understanding of the texts. For teachers, this highlights the need to

foreground important disciplinary vocabulary when teaching academic texts.

The potential to apply EMMA to any population creates a vast appeal to studying

the reading process in fields and disciplines which have until now been the focus of few

empirical studies. While not done with college readers, Hung's (2013) research highlights

many important aspects about reading a science text. Students showed a print-oriented

reading emphasis over visuals. Interestingly, those students that fixated more on the

visuals had higher reading comprehension. These findings support the notion students

need to be taught to not just utilize visuals, but understand their importance in a science

text (Lemke, 1998). Our knowledge surrounding how adult, college learners incorporate

non-text elements with textual elements is lacking and could benefit from similar

research.

A recent study that has worked to fill this void was done by East et al. (in press)

looking at how proficient college students read a disciplinary text using EMMA. They

described how two college students in the MLS discipline were transacting with an

expository science text. Their findings centered on the importance of a reader's prior

knowledge on their understanding of the text being read, readers' strategy use while

reading the disciplinary text, and how EMMA provided further insight into the readers'

comprehension of the disciplinary text. Their work supports that of Hung (2013) where

readers showed a print-oriented approach to the text as well as higher levels of

comprehension from those readers that used the images. The findings of East et al. (in

press) also highlight the importance on the layout of the text itself as an aide to readers'

understanding. They provide important teaching implications for post-secondary teachers

in how to help students approach a disciplinary text.

Summary of Chapter Literature Review

The previous discussions of RMA and EMMA scholarship primarily focused on

college readers, and extended our knowledge about the usefulness of the various forms

Miscue Analysis as a powerful research tool into the reading process. CRMA has the

potential to open a new way of thinking about the reading process for adult learners that

leverages the social construction of knowledge. EMMA research specifically in college

readers and disciplinary experts opens a vast potential to more thoroughly study the

reading process of not only diverse readers, but come to a better understanding about the

reading process in various disciplines as well. The potential for all forms of Miscue

Analysis: RMA, CRMA, and EMMA, to complement our current understanding around

reading in the discipline is vast and supports the need for future research in this area.

Disciplinary literacy includes the specific disciplinary knowledge and the social

and cognitive practices that make up the discipline, and are embedded within the

sociocultural contexts in which they occur. Instruction into these literacy practices in the

college setting should be rooted within each specific discipline through regular engagement with more experienced disciplinary community members as a means to scaffold them into the various disciplinary literacy practices. This dynamic engagement into the disciplinary literacy practices will facilitate students' entrance into the disciplinary community they desire. We need more empirical research into the disciplinary literacy practices of a greater number of disciplines, as well as the active engagement of adult college learners with their disciplinary literacy practices. Using Miscue Analysis and CRMA in the adult learner in the discipline is one specific way to better understand how disciplinary literacy practices are both enacted within the discipline and understood by their community members.

CHAPTER 3

METHODOLOGY

I framed this study as a holistic inquiry, and thus my ontological and epistemological beliefs have driven the methodological nature and design of this study (Creswell & Poth, 2018; Hesse-Biber, 2017; Merriam, 2002). As there are many concurrent and overlapping strategies used during the reading process, and the progression towards disciplinary reading comprehension is different for every individual, so too is the importance of discovering the multitude of ways that understanding of disciplinary text is played out in the profession. With this in mind, this study was primarily exploratory in nature. Research asking *how*, *what*, or *why* is best suited towards qualitative methods and thus is open to the various potential findings that may emerge (Hesse-Biber, 2017). A qualitative approach was thus the best method to learn from and with members of the Medical Laboratory Science (MLS) discipline on how they actively transact with multimodal disciplinary texts, while informing our understanding surrounding the teaching and learning of reading in the discipline.

Research Design

I utilized a qualitative exploratory case study design (Stake, 2006) of one MLS academic program, bounded by those college students, ascending professionals, and faculty professionals who volunteered to participate, to explore how members in the MLS discipline come to understand disciplinary texts and how this understanding simultaneously is able to inform the development and co-construction of disciplinary literacy knowledge. Stake (1995) defines a case as "a specific, a complex, functioning thing" (p.2), often being "a noun, a thing, an entity" (Stake, 2006, p. 1). Thus, a case may

be an individual (a student, a teacher, etc.), a group (a specific class, a professional

organization, etc.), a program, or an event (Merriam, 2002; Yin, 2018). Something that is

"a real-world phenomenon that has some concrete manifestation" (Yin, 2018, p. 31). A

case study is a relevant empirical research method to explore the real-world experiences

of reading a disciplinary text in depth, where the reading task is inherently socially

situated within a disciplinary context (Yin, 2018). When utilizing case study research, the

bounding of the case becomes important to ensure the scope of the study is not too vast

and includes specifying the place, time, and activity (Merriam, 2002; Stake, 1995; Yin,

2018). Further bounding for this study included the disciplinary reading practices of

MLSs connected to Mascar University's MLS program during a 6-month period. Case

study research is not geared toward a specific outcome, finding solutions to problems, or

understanding other cases, but rather generating a greater understanding about a

particular case in a specific context and the process used (Creswell & Poth, 2018;

Merriam, 2002; Stake, 1995; Yin, 2018).

     The research setting is important to define in case study research as it is closely

tied to the focus of the study. Here the focus is at the individual level (Merriam, 2002;

Stake, 1995, 2006; Yin, 2018), a unique MLS program. The setting in which the case

study research unfolds is a connection between the case study (the context) and the case

(the participants) (Merriam, 2002; Stake, 1995; Yin, 2018). The research setting in case

study research is dependent upon the actual factors under study, and how best to research

them in their authentic, real-world situations. By maintaining the study on the campus of

MU, I adhered to the real-world practices and interactions of this MLS program.

With these foundational concepts pertaining to case study research in mind, case study methodology is suited to further explore the transaction of MLSs with disciplinary texts. It can also demonstrate how to better support MLS college students learning of, and inherently the teaching of, the disciplinary-specific reading process. To study these aspects, I used multiple sources of data collection, as outlined below, to triangulate data thereby ensuring trustworthiness of findings.

Researcher Positionality

With the recognition that philosophical assumptions can change over time (Creswell & Poth, 2018), I have seen my own views shift from primarily a post-positivist/realist view towards an interpretivist/social-constructivist view. This shift has developed upon my own self-reflection on learning through my work while in a doctoral program focused on curriculum in literacy. The realization I have experienced in how the interactions amongst students with the teacher and the classroom environment brings about a shared understanding of material and interpretation of reality. I bring this interpretivist view to the ensuing research study. Acknowledging the researcher as the "primary instrument" in qualitative research and everything discovered during the research is "filtered through [their]…worldview, values, and perspective" (Merriam, 2002, p. 22), I find it important to discuss these aspects here as they have been foundational in all aspects of the following study.

I approach this study as a White, married, monolingual mother from a middle-class background. I attended public school and a state university. Reading has always been important in my life and I have enjoyed the process. As a student, I used the textbook for each class they were assigned, and would approach these texts with a

different purpose then I would pleasure reading. I looked to textbooks with excitement

for what I could learn from them, even from subjects I was not particularly fond of. I

have always been intrinsically motivated to learn as much as possible, with a desire to be

as successful as possible.

I positioned myself uniquely along the insider/outsider continuum in relation to

all three participant groups: current college students, ascending professionals, and expert

professionals. I have direct knowledge about what being a student in this program entails,

but I am not currently a student, nor a recent graduate (Bourke, 2014). I could, however,

understand the intensity of the program for the MLS students and I could relate to the

time constraints imposed by taking all laboratory-based courses. I maintain a close

rapport with my students, as each one has gone through an extensive one-on-one

phlebotomy training program as part of an introductory course in the MLS program with

me. However, being their instructor, I am an "outsider" (Bourke, 2014). It has been over

15 years since I was a new MLS graduate, but I vividly remember going to work on my

first day as an MLS – the realization of my responsibility to my patients, their health and

care was now partially in my hands. Again, I have an insider's perspective due to

personal experiences, but I am currently an outsider due to my length of time in the

profession (Bourke, 2014). Two of the expert professionals participating were my

teachers while I attended the same MLS program under study. I thus view them through

multiple lenses: as teacher, mentor, coworker, and friend. As a current faculty member at

MU, I am aware of the pressure of providing a high-quality education while balancing

service and scholarship roles at the university. As one of three principal teachers in the

MLS program on the campus, I am not in a supervisory position in connection to the

other faculty participants. We do share, however, a vested interest in helping our students to be successful. My role in this project was thus instructor, colleague, and researcher.

Theoretical Framework

I maintain the view of literacy as being socially constructed (Gee, 2013; Learned, 2018; Tracey & Morrow, 2017); and connected to the socio-cultural contexts (Street, 1995) which shape them. The idea of culture may be applied to a discipline, and even to individual classrooms, as put forth by Gee's (2013) Discourse communities. The theoretical framework for design of this study and analysis was thus a social constructivist interpretation with the foundation of the transactional sociopsycholinguistic nature of reading (Y. Goodman & Goodman, 2013; Rosenblatt, 2013)**.** This reading model considers reading from a whole language perspective as a meaning-making process, acknowledging the reader as central to the process.

Rosenblatt (2013) highlights a transactional model of reading that is a "dynamic situation. The 'meaning' does not reside readymade 'in' the text or 'in' the reader but happens or comes into being during the transaction between reader and text" (p. 929). There is potential meaning in any piece of text, but it is in what the reader brings to the reading, that meaning can take place. While reading, readers will process graphophonic and syntactic information in an effort to create meaning while reading, and will develop and use various sociopsycholinguistic strategies (Y. Goodman & Goodman, 2013). In other words, as a reader engages in the reading process, they make a series of predictions which are self-tested as they read; predictions based upon their expectations for the text, their knowledge about language, and their schemata, all in an effort towards understanding.

A reader's schema is a basis for understanding new information, providing a scaffold to comprehend new information without altering it, called schema-driven comprehension (Y. Goodman and Goodman, 2013). Alternatively, schema-forming is another means to understanding new information, where existing schema no longer fit and may need modification due to the new information in an effort to promote and support comprehension (Y. Goodman and Goodman, 2013).

Research Setting and Context

This study occurred in the mid-Atlantic region on the campus of Mascar University (MU), drawing participants from the MLS program found on campus. Mascar University is a mid-sized state university whose students are primarily undergraduates (89.2%), under the age of 25 (93%), are female (56%), and self-select as white (69%) (National Center for Education Statistics [NCES], 2020). The MLS program on campus is one of five accredited undergraduate programs in the state.

 For this study, the case under exploration was one MLS academic program bounded by those that volunteered to participate. The context under study was how MLSs actively transact with disciplinary texts and how to better support MLS college students in understanding the reading process in the discipline. Further bounded subcases were grouped as faculty professionals, ascending professionals, and current MLS preprofessional college students to demonstrate the co-construction of knowledge.

The professionals and current students who were able to be on campus due to COVID-19 restrictions, completed their individual interviews, think alouds, RMI, and RMA in my office on campus, as this approximated my regular communication practices with these participants; students regularly come for office hours and advising, and faculty

regularly discuss student and program affairs. My office was a low-pressure environment

for the current students and helped to increase their comfort level in participating, as well

as being conveniently located across the hall from the laboratories they used daily for

their MLS classes. Due to COVID-19 and the location of some of the ascending

professionals and the current students who were attending their clinical internships more

than 60 miles from campus, data collection occurred via Zoom for these participants.

CRMA and small group interviews all took place via Zoom in order to accommodate the

varied locations of participants as well as comply with COVID-19 restrictions of the

university.

The Medical Laboratory Science Discipline

The MLS degree is a four-year bachelor's level degree, which requires both

didactic coursework and clinical experience. MLS programs may be either hospital-

based, which are affiliated with a university, or university-based, which integrate the

professional coursework with a shorter clinical experience. Training includes gaining

competency in "collection, processing, and analysis of biological specimens; the

performance of lab procedures; the maintenance of instruments; and relating lab findings

to common diseases/conditions" (The American Society for Clinical Laboratory Science

[ASCLS], 2012-2020a, para. 2). Medical Laboratory Science includes all forms of

diagnostic testing on patient samples with a knowledge about specimen acquisition,

handling, analysis and reporting. Selecting appropriate equipment, quality assurance, and

laboratory management are also included. The MLS discipline is characterized as

professionals who are generalists, meaning those who graduate and enter the workforce

have been trained in multiple sub-disciplines. The four main subdisciplines in MLS are

clinical chemistry, hematology, microbiology, and immunohematology (also known as

transfusion medicine) (*Becoming A Clinical Laboratory Professional*, n.d.).

Mascar University's MLS Program

Mascar University's MLS program has been well-established since 1975. The

MLS pre-professional undergraduate program at MU boasts a 100% graduation rate from

the second half of the MLS program with a 100% national board certification exam pass

rate and a 100% placement rate into employment or additional graduate educational

programs. Mascar University's MLS program includes the four main sub-disciplines of

clinical chemistry, hematology, immunohematology, and microbiology. The

preprofessional MLS program at Mascar University is a 2+2 model. Students apply for

admission to the program in their sophomore year, so that students taking disciplinary

courses are in their junior and senior years.

When this study began, Mascar University had three fulltime faculty and two

adjunct faculty in the MLS program. Each faculty member had a different sub-discipline

of focus. The two adjunct faculty members have continued to work fulltime in healthcare

as MLSs. At the start of the study, I had been the hematology instructor at Mascar

University for six years. I was a student under two of the current faculty members and,

following my own graduation from the MLS program, was a coworker of two faculty

members at the local hospital/trauma center. I have had a personal and professional

relationship with most of them over the past 19 years. Each faculty member has devoted

their career to healthcare and works tirelessly to apprentice students into the profession.

The combined MLS experience between the faculty was approximately 150 years at the

time of the study.

As the next closest MLS program was over 90 miles from MU, many graduates obtain employment in the surrounding local hospitals. Many MLSs remain in the field for their entire career. The Bureau of Labor Statistics (n.d.) describes the job outlook as positive with a "faster than average" expected growth rate, related to an expected increase in the need for laboratory testing in healthcare. There were approximately 70 ascending professionals who were in their first five years of employment post-graduation from MU at the time the study began.

The participants in this study were a natural reflection of this MLS program. The MLS program at MU is a close-knit program that fosters many relationships amongst students, graduates, clinical affiliates, and faculty. The program director remains in touch with many graduates and has even had children of former students in her class. The participants, although coming from a widespread geographical basis, did have exposure and interactions with each other outside of this study. During introductions in the first group session, one student and ascending professional had already met during that student's clinical rotation. Another student had already accepted an employment opportunity and was going to be working in the same laboratory as a second ascending professional. One of the expert professionals worked daily with another ascending professional. This MLS community was thus not artificially constructed for the purposes of this project, but rather one that has a long history of close connections amongst varying levels of expertise and ties to the broader MLS community.

Participants

A central goal of this study was to explore the disciplinary reading practices in one MLS program and how to better support the teaching and learning of disciplinary

reading. To obtain a diverse and inclusive sample, three primary groups of participants with variable levels of MLS experience were included: faculty professionals, ascending professionals, and current college students, described below. Purposeful sampling (Hesse-Biber, 2017) was used to recruit faculty professionals from Mascar University's MLS program via email. Similarly, recent Mascar University graduates that were ascending professionals at the time of recruitment were solicited using the MLSs recent graduate email list and the closed social network group of the University's MLS Alumni. Finally, current MLS preprofessional college student participants were solicited using purposeful sampling (Hesse-Biber, 2017) via their student email account.

     I selected participants on a first-come, first-served basis. A summary of all participants is found in Table 1, more detailed descriptions of each participant are below.

Table 1

Participant Demographics

Participant	Group Classification	Specialty Sub-discipline	Years as a MLS
Logan	College student	Transfusion Medicine	Junior
Mary	College student	Microbiology	Senior
Norma	College student	Microbiology	Senior
Max	College student	Hematology	Senior
Rylee	College student	Microbiology	Senior
Lailah	Ascending Professional	Hematology/chemistry	3
Darrin	Ascending Professional	Microbiology	3
Violet	Ascending Professional	Hematology/chemistry	2
Bethany	Faculty Professional	Chemistry	40
Mona	Faculty Professional	Microbiology	33
Zoe	Faculty Professional	Transfusion Medicine	19

College Students

All participants were at least 18 years old, at minimum they were junior level college students. Current MLS students are accepted into the MU MLS program as a cohort and progress through the entire program together. Each fall a maximum of 18 students are accepted into the program. The number of admitted students is limited by the ability to place students into clinical internships in their final, senior semester. The Mascar University MLS program has articulation agreements with surrounding community college Medical Laboratory Technician (MLT) programs. This agreement

allows successful MLT graduates to matriculate into the MLS program in the spring of the junior year. The number of MLT students at MU varies, some years there may not be any MLT students, other years there may be one or two. I invited all students who were currently enrolled in the MLS program during the Spring 2021 semester as participants, thus they could be either juniors or seniors. At the time of recruitment there were 13 juniors and 13 seniors enrolled in the MLS program.

Looking at the MLS program under study from a narrative inquiry perspective (Montero & Washington, 2011), the program was 85% female and quite diverse with students from multiple races including Asian, Black, and White. All students attended school full time during the semester described. The junior class was enrolled in three laboratory-based science courses: the hematology course I taught, as well as biochemistry and microbiology. The senior class was completing their clinical internships during the spring semester under study and were not attending classes on campus on a daily basis, but rather were working in local hospital laboratories 40 hours weekly. Most students in the program worked part-time jobs, and a few were also enrolled in additional chemistry or biology courses to complete a minor or were completing general education course requirements. For most of the junior level students this was their second semester in the MLS program, having taken two foundational courses the prior semester, one of which I was their instructor, and I had established a good rapport with them prior to the start of this study. For the senior students, this was their second year in the MLS program and I had known each of them since they started the MLS program, some of them longer.

I used a purposive sample (Hesse-Biber, 2017) of MLS upper level junior and senior status undergraduate students enrolled in the MU MLS program during the Spring

2021 semester. They had all attended multiple MLS disciplinary courses at the time of

their readings used for data gathering. I had first-hand knowledge about their individual

levels of background knowledge in relation to any hematology texts being read, but only

a general understanding about their expected knowledge in relation to their class status in

other MLS disciplinary courses. I had five student participants described below. For this

study I had one junior, Logan (pseudonyms used for all participants), and four seniors:

Mary, Norma, Max, and Rylee volunteer to participate.

      Logan. At the time of the study, Logan was new to the MU MLS program. He

had just graduated with his associate's degree and passed his MLT certification exam the

month prior to the start of the spring semester. He attended classes during the week and

worked as an MLT at the local hospital in the transfusion medicine department on the

weekends during this study. He was a quiet student and careful observer during class.

Classmates visibly looked up to him, as he already had his MLT degree and was working

in the laboratory. In addition to English, he can speak and read in French and at the time

of the study was learning Norwegian on his own. His interest in Norwegian stemmed

from listening to interviews of a musical artist he enjoyed and thinking the language

sounded pretty.

      Mary. Mary was a traditional student; she started at MU as a freshman and from

day one wanted to become an MLS. She noted many of her relatives were in the medical

field, but saw herself as more of "an introverted book nerd" and she wanted something

other than biology. She noted doing some research during her senior year in high school

and came across the major. She was monolingual and reports as a child she was "a big

bookworm." During class she was a quiet and reserved student but was always engaged with the material being covered.

Norma. Norma reported she initially wanted to go into medical school but when she realized the amount of paperwork involved and that she would be "dealing with people" she reconsidered her options. She enjoyed biology but loved the medicine and molecular aspect and subsequently discovered MLS. Even after starting in the MLS program, she considered switching to a chemistry major, but ultimately enjoyed the variety of topics the discipline provided. She took three years of Spanish but noted "I don't remember any of it." Norma was another quiet student in the classroom, but during the lab her witty personality would come out.

Max. Max was born in America to parents that immigrated from Pakistan. As a young reader his parents encouraged him to read in both English and Urdu, their native language, "while my siblings were teaching me how to read English, at the same time, my parents were teaching me how to read Urdu." He recalled reading the news in addition to short stories in Urdu as a young child, "if there's anything written anywhere, they would have had me read it." He reported being fluent in English, Urdu, and Punjabi, and that he could understand and speak slightly Arabic and Spanish. Max would love to ultimately become a physician assistant and felt learning the science behind all of the lab testing would benefit him for future coursework. This was not my first time working on Miscue Analysis with Max. He was a volunteer for my pilot project research using EMMA the year prior to this study. However, he had not participated in any collaborative RMA sessions, only individual RMA. In the classroom Max was an upbeat participant, frequently answering questions and making jokes with his classmates.

Rylee. Rylee was a local girl. She was born and raised within 30 miles of Mascar University. She reported English as her primary language, knowing "a small bit of Spanish," and added she did take a course in American Sign Language and was able to communicate slightly through sign. She would like to learn more sign, but reported she did not have much spare time. Like Max, Rylee also participated in my pilot project study and thus was familiar with the process of Miscue Analysis. Rylee became involved with MLS because she loved the science behind helping people get better, but did not want all the direct patient contact of other fields in medicine. Rylee was another quiet student in the classroom whose ironic personality was able to come out during lab sessions.

Ascending Professionals

The American Society of Clinical Laboratory Scientists (ASCLS, 2012-2020b) classifies ascending professionals as those working in the MLS field who are graduates within the past five years. I adhered to this classification and invited those recent MU graduates who were currently working in the MLS discipline. I had three ascending professionals participate. I was an instructor to all the participating ascending professionals. As they have transitioned out of the classroom and into the profession, I regard these participants as colleagues in the discipline. The three ascending professionals who participated through the entire study were Lailah, Darrin, and Violet. Their unique perspective of having successfully completed MU's MLS program combined with their experience of transitioning from student to professional, provided invaluable insights for disciplinary reading.

Lailah. Lailah had been an MLS for three years and worked at a large metropolitan hospital since graduating. At the time of the study she was working evening

shifts in the core lab as a generalist. At work she would alternate between "benches" performing chemistry tests, hematology/coagulation tests, and urinalysis. She noted she occasionally would help with basic microbiology duties if needed. Lailah remembered her uncle first introduced her to the profession when she was a senior in high school and she has found it to align with her interest in medicine and her "values in terms of my education." At the time of the study, Lailah was planning on pursuing a graduate degree in the laboratory as a pathologist's assistant. She was born in America but did live in Nigeria for three years as a teenager. She reported in addition to English she can understand and speak a small amount of Yoruba.

Darrin. At the start of the study, Darrin had also been an MLS for almost three years, she had been Lailah's classmate. Darrin had been working at a separate large metropolitan hospital since graduating, but had transitioned from a general microbiology position to one focused in molecular microbiology. She had always been interested in the science behind the testing and noted her dad was a lab tech. While in college she took her first microbiology course and fell in love with the work. In her job at the time of the study, she noted she may run an analyzer "or especially recently, with COVID, it's been – I work as a team with other people, so maybe I do one portion of the COVID setup that day, the next day…I do the PCR." She added that almost daily she was able to work on "whatever research project I have going on." Darrin was born and raised in the US; in addition to English she could also communicate in sign language.

Violet. Violet had been an MLS for two years but felt impelled to add "four years if you count school." She identified as an MLS even while in school, but noted she actually didn't decide on the career path until just before her application for MU's MLS

program was due. Violet recalled first enjoying anatomy in high school, and liking the

science in medicine, and considered pursuing a doctorate in nursing. Her mother, a nurse

herself, introduced Violet to the MLS profession as a better option for her. She had been

working in the core lab at the local trauma center since she graduated. Similar to Lailah,

she would rotate benches, working automated chemistry, urinalysis, and hematology. She

noted she preferred hematology, "it all makes me happy, but I do like subjective science

and diffs and looking at cells." Violet had lived in the area her whole life and aside from

English, knew a small amount of Spanish.

Faculty Professionals

The faculty at MU fall under the ASCP classification of a professional (ASCLS,

2012-2020b) and are considered both academic experts and practitioners. All the MU

faculty members were recruited and three volunteered to participate: Bethany, Mona, and

Zoe. Each of the professionals has over 10 years of clinical laboratory experience as well

as many years serving as both educator and mentor to students in the classroom and in

clinical practice. Bethany and Zoe had each gone through the MLS program at Mascar

University. The three faculty have a long, rich, history with the MU MLS program as

described below. Their insights as an expert from both a clinical and pedagogical

standpoint proved enlightening and rewarding for participants in this study.

Bethany. At the time of the study, Bethany had been the MLS program director at

MU for 10 years and had been teaching in the MLS program for 34 years, most recently

biochemistry and immunology. She received her PhD in Immunology while teaching at

MU. She had been an MLS for almost 41 years when the study began. She worked at the

local trauma center after she graduated, and after she became a senior tech, she recalled

taking on more management duties and not enjoying that. It was around that time her children were starting school and she began the transition to primarily teaching to better accommodate their schedules and noted how she did not expect to remain in education so long. She remained at the hospital in a part-time capacity up until about five years before the study began. Bethany remembered first discovering the profession in about ninth grade when she completed a career project looking at three careers. She recalled wanting to be a doctor and having to identify something else for the project. MLS was initially her backup plan, but after realizing how hard it was to get into medical school, she decided on a major she felt to be "safe," it was "something I could get a job at." As a teacher, Bethany would take her role seriously and saw herself as someone who had the "chance to help shape" her students, adding "I feel like that any kid that leaves here, that knows how to do it right, that my effect on the world is multiplied."

      Mona. At the time the study began, Mona had been an MLS for almost 34 years. She was working as the microbiology supervisor at the local trauma center and had been teaching microbiology at MU for the past eight years. Mona had her Masters in Microbiology and stated she never finished her PhD, "I stopped with the dissertation" at which time she started her family. She recalled first discovering the MLS field while in high school at a career fair and fell in love, "this just clicked for me." She added she also had a natural affinity for teaching "I was always trying to teach my younger sister things." She noted in the hospital she always enjoyed working with students in the laboratory during their clinical rotations and training them. Prior to teaching at MU, she had other general microbiology teaching positions at community colleges, but felt the clinical microbiology was a better fit for her which she really enjoyed. Her love for

teaching was evident in her interactions with the students, and many of them have chosen

to work with her after graduation as MLS microbiologists.

   Zoe. Zoe had been a professor in the MU MLS program for ten years, starting

first as an adjunct and then transitioning into a full-time faculty position. She received her

Ed.D. while she was teaching at MU. She was working in transfusion medicine/blood

banking at a local trauma center when she was recruited to start teaching at MU, and at

the time of the study she would still fill in on an as-needed basis. She noted that teaching

gave her something different than working in the lab, "it is interesting and different." She

had been an MLS for 19 years at the time of the study. Zoe was also the clinical

coordinator- overseeing the senior students while they were completing hospital rotations

their final spring semester during the study. She remembered being in college when she

was introduced to the major and when she heard "the magic words of you're pretty much

guaranteed a job when you graduated, and I was like, oh – sold! I'm done, I'm good!" Zoe

had always been a strong advocate for the MLS profession and managed MU's social

media accounts while also serving on the board of the state MLS association.

Data Sources

   Integral to providing an in-depth portrait of the case being studied, multiple forms

of data are used in case study research (Creswell & Poth, 2018; Merriam, 2002; Hesse-

Biber, 2017; Stake, 1995, 2006; Yin, 2018). The specific data sources used relate back to

the research question and the case itself. The types of data collected were varied, as

outlined below and summarized in Table 2, as a way to triangulate data thereby ensuring

trustworthiness of findings and increasing validity (Yin, 2018).

Table 2

Data Sources Gathered, Participants, and Rationale

Data Source	Participant (total per participant)	Rationale
Burke Reading Interview (BRI) modified for adult readers (Y. Goodman et al., 2005)	Faculty Professionals (1); Ascending professionals (1); College students (2)	To understand how participants identify as a reader and their current beliefs about MLS reading.
Think Aloud (Harp, 2006)	Faculty Professionals (1); Ascending professionals (1); College students (1)	To better understand readers' metacognitive processes with disciplinary texts.
Uninterrupted Oral Reading	Faculty Professionals (1); Ascending professionals (1); College students (2)	To observe participants' oral reading of a disciplinary text for RMI, RMA, and CRMA.
Retellings: Unaided and aided (Y. Goodman et al., 2005)	Faculty Professionals (1); Ascending professionals (1); College students (2)	To evaluate each readers' comprehension of the disciplinary texts read.
Semi-Structured Think Aloud and Oral Readings Follow-Up Individual Interview	Faculty Professionals (1); Ascending professionals (1); College students (1)	To understand reader's strategic moves while engaged with disciplinary texts and provide clarity of observations from the think alouds and oral readings.
Retrospective Miscue Analysis (Y. Goodman et al., 2014)	Faculty Professionals (1); Ascending professionals (1); College students (2)	To allow for a flexible, reader-centered discussion of the reading process.
CRMA (Costello, 1992)	Faculty Professionals (5); Ascending professionals (4); College students (4)	To engage participants in collaborative conversations about the MLS disciplinary reading process. (see Tables 5 and 6).
Artifacts	Faculty Professionals Ascending professionals College students	To collect artifacts depicting the various disciplinary literacy practices used in this study.
Researcher Memos and Field Notes	Researcher	To document my thought process and ideas as I worked across data sources and participants toward answering my research questions.

Burke Reading Interview (Y. Goodman et al., 2005)

I first interviewed each reader using the semi-structured Burke Reading Interview (BRI) Modified for Older Readers (Y. Goodman et al., 2005; see Appendix A) to understand how each participant identified as a reader, discuss past reading experiences, as well as their current beliefs about reading. During this interview I also began the conversation with each reader about MLS disciplinary-specific texts and reading practices. This interview additionally gave me the opportunity to get to know my participants better. Ascending professionals and college students completed a post-study modified BRI. The post-BRI was completed to assess how participants' views about disciplinary reading changed during the course of this study. The BRI was completed individually with each reader and was audio-video recorded for transcription and analysis.

Think Aloud (Harp, 2006)

Each participant completed a think-aloud session using one self-selected text from their stated subdiscipline that they provided but had not previously read. Subdisciplines were used for the expert professionals and the ascending professionals. As the college students were still novices in the MLS discipline, they were given the opportunity to select a disciplinary text in the subdiscipline of their choosing. Individual sub-disciplinary text selection, while logistically complex for the study, was used with the understanding that individual experience and expertise would play into how the participant would read a disciplinary text. The think alouds followed a semi-structured protocol to allow for follow-up on emerging thoughts and ideas (Hesse-Biber, 2017), and were audio-video recorded for transcription and analysis. The purpose of the think alouds

was to gain insight into how the readers were coming to understand their selected text. They are "verbalizations of what a reader is thinking as he or she is reading" (Harp, 2006, p. 125). Think alouds, used in combination with Retrospective Miscue Analysis, were a way to provide evidence of how each reader was actively constructing meaning.

Reading Miscue Inventory Data

To complete the Reading Miscue Inventory (Y. Goodman et al., 2005), I used each readers' uninterrupted oral reading, their subsequent unaided and aided retellings (Y. Goodman et al., 2005), and the Procedure III form (Davenport, 2002) to mark and code each readers' typescript. Marking is the process of identifying where the reader's oral reading differs from the printed text, and coding helps determine how each reader integrated their language cuing systems for meaning-making. The Reading Miscue Inventory (RMI) shows how the reader is engaging with a text and provides important insight to their comprehending in process. I used the combination of these data sources to structure the ensuing Retrospective Miscue Analysis and Collaborative Retrospective Miscue Analysis.

Disciplinary Text Selection

Participants self-selected the text they read for the think aloud from their stated sub-discipline of choice. I provided each reader with two options from their stated sub-discipline of choice to select from for the first oral reading. The college students all read the same second disciplinary text which I selected. I collected the authentic disciplinary texts selected by each reader for their think-aloud and any notes the reader jotted down on the text while completing their reading. Faculty professionals and ascending professionals selected a MLS reading from their stated sub-discipline, the college

students were able to select from any of the four subdisciplines (chemistry, hematology, microbiology, and transfusion medicine).

Selection of text that I provided for the oral reading was dependent upon the subdisciplines represented. For each of the four MLS sub-disciplines, I pre-selected two authentic disciplinary texts to read out loud. Immediately prior to the oral reading, each reader viewed the two possible texts and selected the one they wanted to read out loud. Each text was representative of common disciplinary texts encountered in the profession. Selections were varied but each subdiscipline included one case-study that had many multimodal features including images, figures, charts, or tables. The other possible texts to choose were varied and included a blog, an interview, and a continuing education article. Each person in a subdiscipline may potentially read the same text, so anyone stating chemistry as their discipline of choice read one of two chemistry texts. See Table 3 for key features of each text orally read for the first RMI session, including word count, figure count, and table count. Additionally, the college students all read the same MLS disciplinary multimodal case study for their second oral reading. Table 4 includes key features of the second orally read text completed by the college students.

Table 3

Description of Texts Read for First RMI Session

Texts Used	Participants	Pages	Word Count	Figures	Tables
Methods of testing platelet count and Function (Riley, 2020)	Max (cs) Lailah (ap)	4	2344	1	1
Severe Underestimation of Serum Na following IVIG Treatment (Virk et al., 2018)	Bethany (fp)	5	1366	3	1
Variable Potassium Concentrations: Which Is Right and Which Is Wrong? (Theparee et al., 2017)	Violet (ap)	4	1694	1	2
Acute Hemolytic Transfusion Reaction Due to Pooled Platelets: A Rare but Serious Adverse Event (Gammon et al., 2020)	Logan (cs) Zoe (fp)	3	1331	1	1
New tools combat a complex antimicrobial resistance problem (Flayhart, 2020)	Mona (fp) Rylee (cs)	4	2935	0	2
A Noninvasive *Rhizopus* Infection With a Bladder Fungal Ball in a Patient With Poorly Controlled Diabetes Mellitus (Barnes et al., 2017)	Norma (cs) Mary (cs) Darrin (ap)	5	1777	3	0

Note: cs = college student, ap = ascending professional, fp = faculty professional

Table 4

Key Features of Text Read for Second RMI Session with College Students

Texts Used	Pages	Word Count	Figures	Tables
Markedly Elevated Indirect Bilirubin in an 11-Year-Old African American Boy: Normal or Aberrant? (Chang, et al., 2013)	5	1144	3	2

Oral Reading Samples for First Reading Miscue Inventory (RMI)

Immediately after each reader completed the think aloud, they completed an uninterrupted oral reading. I provided two texts from their stated subdisciplines for them to choose one of which to read out loud (see Table 3). College students completed two oral readings, ascending professionals and faculty professionals completed one oral reading. A typescript of each text read was created. The oral reading was audio-video recorded to enable marking and coding of their typescripts and for subsequent use in RMA and CRMA, described below. The uninterrupted oral reading, used in combination with the think-aloud helped to provide evidence of each reader's individual reading process.

Oral Reading Samples for Second Reading Miscue Inventory (RMI)

The current college students additionally completed a second uninterrupted oral reading (see Table 4) in-between the third and fourth CRMA sessions. The same text was used by each college student for this reading and a typescript was created. Having the second oral reading in the middle of the study provided additional insights into each of the college student's reading process and enabled them to reflect more fully upon their own shifting views on reading. They had participated in both RMA and CRMA sessions, described below, and had a greater understanding about how their oral reading could be used as a learning experience on disciplinary reading. The oral reading was audio-video recorded to enable marking and coding of their typescripts and for subsequent use in RMA and CRMA, described below. In total, each faculty professional and ascending professional completed one oral reading and each college student completed two oral readings.

Unaided and aided retellings

Following the oral reading, each reader completed an unaided and then an aided retelling using a semi-structured retelling protocol to evaluate comprehension. Unaided retellings were completed first and were used to show how the reader was constructing meaning. This provides the reader with an opportunity to present the text as they have understood it and they are able to begin in any form. The unaided retelling is done without any prompts from the researcher. Retellings may be oral or may be multimodal and include writing, drawings, or sketches. Each reader completed one oral retelling following their oral reading. Since faculty professionals and ascending professionals completed one reading, they subsequently also completed one retelling. The college students completed two retellings (see Table 2). Aided retellings followed the unaided retellings. Retellings by themselves, while valuable, "never represents a reader's total understanding of the text; readers rarely tell all they know" (Y. Goodman et al., 2005, p. 55). Aided retellings are completed with open-ended questions based off of the unaided retelling to increase readers retelling using participants own words. The aided retelling provides an opportunity for the reader to provide further detail about their understanding of the text read and to "provide insight into the *reader's construction of meaning*" (Y. Goodman et al., 2005, p. 59, emphasis in original). Retellings were audio-video recorded and transcribed for analysis, and for use in RMA and CRMA sessions, described below. I used both a Holistic Evaluation form (Davenport, 2002) and an In-Process Reading Strategies form (NCTE, 2001) with each reader to evaluate overall comprehension based upon information revealed during the retelling sessions.

Semi-Structured Think Aloud and Oral Readings Follow-Up Interview

Immediately following each reader's first oral reading, I held an individual semi-structured interview with open-ended probing questions (see Appendix B) based upon comments made during the think-alouds as well as their oral reading and retelling. This provided a deeper understanding of how participants were transacting with their disciplinary text. This interview also served the purpose of determining aspects of reading as related to both the MLS discipline and sub-disciplines felt to be important to participants. This interview was audio-video recorded for transcription and analysis.

Retrospective Miscue Analysis (Y. Goodman et al., 2014)

I held an individual Retrospective Miscue Analysis (RMA) session following each reader's oral reading to discuss any unusual or unexpected miscues unique to each individual reader, or other unique revelations about how the reader was interacting with the text from the uninterrupted oral readings. The marked and coded typescripts of the uninterrupted oral readings were used. The individual RMA session allows for a flexible, reader-centered, collaborative dialogue about their reading process to provide additional insight into participants' work at comprehending (Y. Goodman et al., 2014). RMA sessions began with the attached RMA session organizer (see Appendix C), but were unable to be pre-determined as the miscues that were highlighted were dependent upon each individual oral reading. I facilitated this first RMA session, as this was the first time many of the participants had completed an RMA session. High quality miscues, where meaning was retained, were a focus of the session. This allowed participants exposure and practice in discussing miscues, while maintaining the experience as a positive endeavor. The college students completed a second session following their second oral

reading. This second RMA session was primarily student-led, as they then had experience

with both an individual RMA session and CRMA (described below), allowing for

agency. Both sessions had a disciplinary focus.

Collaborative Retrospective Miscue Analysis (CRMA, Costello, 1992)

I held a total of 5 CRMA sessions, all via Zoom. The first CRMA session

involved just the Faculty Professionals. The second, third, and fourth sessions involved

small mixed groups of all participants (see Table 6). An instructional guide previously

used with adolescents to instruct on the process was adapted for the college setting

(Costello, 1992; see Appendix D) and was used during each CRMA session. I also used a

CRMA session organizer to guide the sessions (see Appendix E). To accommodate

everyone's varied schedules, I split participants into one of two Teams for CRMA

sessions two through four, a Saturday morning Team and a Monday evening Team. I

facilitated a total of six mixed group CRMA sessions. Each of the Teams (Saturday and

Monday) covered similar material but with different participants. In the fifth CRMA

session participants were grouped by classification: college students, ascending

professionals, and faculty professionals. Table 5 lists and summarizes the topics covered

during each CRMA session. A list of the participants for each CRMA session is included

in Table 6. I held the CRMA sessions at approximately one-month intervals and they

were audio-video recorded for transcription.

Table 5

CRMA Data Collection Description

CRMA session	Topics Covered
1	Introduction to CRMA and explanation of faculty professionals' role in future CRMA sessions.
2	Introduction to CRMA workshop, practice with marking typescripts and using CRMA session organizer, and the faculty professionals' oral readings discussed.
3	CRMA workshop with "Boat in the Basement" and EMMA. Ascending Professionals' and College students' oral readings discussed.
4	CRMA workshop focusing on retellings. Student led CRMA of college students' second oral readings.
5	Final thoughts on MA, RMA, and CRMA. Focal group with semi-structured questions on salient ideas.

Table 6

Team Participants for Each CRMA Session and Meeting Length

CRMA session		Meeting Length (min)	College Students	Ascending Professionals	Faculty Professionals
1 – Introductory Workshop		43			Bethany, Mona, Zoe
2	Team A	66	Max, Riley	Lailah, Violet	Bethany
	Team B	68	Mary, Norma	Darrin	Zoe, Mona
3	Team A	62	Max, Riley	Lailah	Bethany, Mona
	Team B	62	Mary, Norma, Logan	Darrin, Violet	Zoe
4	Team A	69	Max, Riley	Lailah	Bethany
	Team B	75	Mary, Norma, Logan	Darrin, Violet	Zoe, Mona
5 – Focal Group	Faculty Professionals	70			Bethany, Mona, Zoe
	Ascending Professionals	72		Darrin, Lailah, Violet	
	College Students	70	Logan, Mary, Norma, Max, Rylee		

CRMA Session One

The first CRMA session I facilitated was a workshop with the faculty professionals to explain the CRMA process and to allow them the chance to practice completing a session. I wanted to use the faculty professionals' inherent teaching abilities and use them as models for the mixed group CRMA sessions with ascending professionals and current students. This session was purposefully done to make the faculty professionals aware that I would start the mixed-group CRMA sessions using their oral readings, in an effort to decrease the sensation of a power differential between participants and allow a more open discussion in subsequent CRMA sessions. During this first session I used a short oral reading of a hematology text I had read to demonstrate the process. I held this session after each of the faculty professionals had completed their individual RMA, so they were aware of the idea of Miscue Analysis.

CRMA Sessions Two through Four

The CRMA sessions two, three and four were small groups of a mix of faculty professionals, ascending professionals, and current MLS students (see Table 6) to discuss any miscues common to all readers, unusual or unexpected miscues unique to individual readers, or other unique revelations about how the readers were transacting with the text. To aid in the co-construction of knowledge while harnessing the inherent power differential between expert and students, the faculty professionals helped mediate (Vygotsky, 1978) knowledge gains in students. The CRMA allowed for direct benefits to student participants as well, providing both exploration of the disciplinary reading process as well as discovery of reading strategies being used to construct meaning.

CRMA as a process helps to bring forth the tacit knowledge and reflections of the faculty experts for students.

      CRMA Session Two. The second CRMA session involved two small Teams of all participants and served as an introduction to the process, while allowing time to practice using CRMA (see Tables 5 and 6). There were eleven participants total in this study. I wanted to encourage an open discussion during each session where all participants had the opportunity to speak and be heard, to allow for this I split participants into one of two Teams based upon their schedules. Some of the ascending professionals worked evenings and were only available during the day, others were working during the day and only available in the evenings. As participants were working in healthcare during a pandemic, the Teams remained flexible in who participated. However, most participants did remain in one team for the entire study. By keeping to the same teams, this also increased the likelihood of participation as each reader became more comfortable sharing over time.

      I invited the three faculty professionals to participate as models to help ascending professionals and college students gain comfort in the process, as they had already completed the first CRMA session with me. The second session began with a workshop for participants and included an introduction to the CRMA process. Participants were familiarized with how to mark a typescript and the CRMA session organizer was explained. I began the second session for both Teams with the same oral reading I had completed with the faculty professionals during session one. I encouraged each participant to identify miscues I had made during my oral reading and to begin the process of discussing miscues. As I had previously explained to the faculty professionals,

I then transitioned to their oral readings. During each participants' individual RMA session, we covered multiple miscues and identified short segments of their oral reading that would be used during the CRMA process. I maintained each of the CRMA sessions at approximately one hour to not keep participants for an undo amount of time. Due to this, during the second CRMA session we were unable to cover each participant's oral reading. Readings not covered carried over to the following CRMA session. Samples came from all participant groups, and participants had the opportunity to work together to discover how readers are coming to understand the text they are transacting with.

CRMA Session Three. The third CRMA session for both Teams also began with a short workshop session where I introduced them to the text "Boat in the Basement" which contains multiple embedded errors. The purpose of this exercise was to make evident to the readers how reading is not just what the eye sees, but rather how our brain processes the information, making sense of the printed text as a whole (K. Goodman et al., 2016). During the workshop for this session participants were also introduced to eye movement miscue analysis (EMMA) to stimulate a rich discussion surrounding the reading process. Data for this included previously collected EMMA from MLS students (East, 2020; East et al., in press). In those studies, MLS students read aloud a disciplinary text while their eye movements were video-recorded. Recordings included eye movements across the text, static images of eye fixations, saccades, and blinks, as well as heat maps overlaying the text. These CRMA sessions also included the remaining participants' oral reading samples, first the ascending professionals and then the college students. This provided additional insight into the various ways disciplinary reading manifests and the challenges faced by all participants in their textual transactions.

CRMA Session Four. Between the third and fourth CRMA sessions, the college students participated in their second individual oral reading, retelling, and RMA session. During their individual student-led RMA session, students identified portions of their readings they wanted to bring to the group to cover during the fourth CRMA session. I also identified a few areas in the text where each of the students miscued. These student-selected and common miscues were the focus for discussion for each group during the fourth CRMA session. The workshop during this session focused on a discussion surrounding the utility of retellings following an oral reading. Sample retellings from the faculty professionals were used as exemplars.

CRMA Session Five

I held a fifth and final CRMA for each separate group of participants (faculty professionals, ascending professionals, and current students). This final CRMA allowed participant to self-reflect on the process of Miscue Analysis, Retrospective Miscue Analysis, and Collaborative Retrospective Miscue Analysis as well as generate their final thoughts regarding some of the miscues previously discussed. This session also ensured clarity around previous CRMA sessions using a semi-structured approach (see Appendix F). It was determined in part by initial analysis of previously collected data and progressed as an open discussion. Preliminary analysis demonstrating the most salient ideas were brought to the participants for confirmation. A second focus in this session was to discuss the various aspects about the disciplinary reading process in MLS and which were felt to be important to demonstrate and teach to novice college students learning the discipline, as well as ideas on how to approach this in the classroom.

Field Notes

Researcher field notes during think-alouds, RMA sessions, CRMA sessions, and small group interviews were recorded. This allowed for a rich description of the setting and participants (Creswell & Poth, 2018; Hesse-Biber, 2017), while also documenting important moves participants made to further support analysis of the case under study, and I used them to help interpret developing findings.

Researcher Memos

Throughout the data collection process my researcher memos were used to document my thought process and developing ideas as I worked across data sources and participants toward answering my research questions (Creswell & Poth, 2018). This allowed for a recursive, thoughtful exploration of emerging codes as well as an exploration of my own biases, and helped guide further collection of data. Researcher memos were an initial part of data analysis.

Artifacts

I collected the self-selected disciplinary texts participants read during their think aloud that included annotations and notes they made during their reading. I also used RMA session organizers and the participant completed CRMA session organizers to further understand the disciplinary reading practices of the participants. Any notes made by participants during the CRMA sessions were similarly collected for analysis.

Data Analysis

Keeping the research questions in mind, I triangulated and analyzed each data source to see how it contributed toward an understanding into how MLSs are reading in the discipline and how CRMA informs the teaching and learning of reading in the

discipline. The goal was to represent the data as true to the lived experience of the case

study as possible. The complex and multidimensional portrait of reading described was

supported by how these multiple data sources interact and increased the reliability and

validity in the findings (Creswell & Poth, 2018; Hesse-Biber, 2017; Yin, 2018). I began

data analysis as soon as data was collected and it was ongoing throughout data collection,

allowing for a recursive process (Stake, 1995, 2006). I gave consideration to alternative

explanations of findings throughout data analysis (Yin, 2018).

Analysis of Individual Interviews, Retellings and CRMA sessions

Burke Reading Interviews (Y. Goodman et al., 2005), think alouds (Harp, 2006),

oral readings, retellings, RMA's (Y. Goodman et al., 2014), CRMA's (Costello, 1992),

transcripts (of the retellings, interview sessions, and CRMA sessions), field notes and

memos were analyzed using multiple cycles of coding through NVivo® to develop

themes upon reflection of the data (Saldaña, 2016). I determined the specific types of

coding styles after data was collected, as the various types of data helped to lead the

analysis. I began with In Vivo Coding and Process Coding, followed by Pattern Coding,

and I created a codebook. In Vivo Coding allowed the participant's voice to take priority

and was important to gain an understanding of each participant's background and views

on reading (Saldaña, 2016). This allowed a more complete picture to develop. I utilized

Process Coding of the CRMA sessions to better see the strategic moves that were being

made during these group interactions by participants. I collapsed and merged codes upon

continual reflection of data to help identify how the data best fit together and allow for

exclusivity of each code. I used Code Mapping as a way to help organize codes into

categories (Saldaña, 2016). Pattern Coding as a second cycle coding scheme enabled

refinement of larger groups of initial codes down into smaller, more concise groupings and enable themes to develop (Saldaña, 2016). Jottings occurred during and after each interview to enable initial thoughts to be recorded for later reflection and analysis (Creswell & Poth, 2018; Saldaña, 2016). Researcher field notes and memos allowed for further reflection on developing themes.

Miscue Data Analysis

I analyzed Miscue Data at the sentence level from a marked and coded typescript using the RMI Procedure III- Reader profile form (Davenport, 2002, see Appendix G) to allow statistical analysis of miscues. As miscues are a reader's observed response that differs from the printed text, Miscue Analysis enables the study of a reader's proficiency and the reading process by evaluating what the reader does when reading, providing both qualitative and quantitative data (Y. Goodman et al., 2005). When a reader transacts with a text, they utilize multiple reading strategies in combination with the language cuing systems (the graphophonic system, the syntactic system, the semantic system, and the pragmatic system) to create meaning, and these in turn form the basis of miscue analysis (Y. Goodman et al., 2005). I used the typescript to document the reader's oral rendition of the text. Markings on the typescripts show any miscues made by the reader as they completed an oral reading, for example: substitutions, omissions, insertions, and repetitions (Y. Goodman et al., 2005; see Appendix H). I used the markings to subsequently code each sentence by asking if each miscue was syntactically and semantically acceptable and if the miscue created a meaning change. These codings provide evidence of a reader's comprehension in process (Y. Goodman et al., 2005). It is important to consider meaning change from the readers primary language. If a reader

produced a sentence identical to the printed text it was coded as syntactically acceptable, semantically acceptable, with no meaning change: YYN, where Y is yes and N is no. Sentences coded as YYN demonstrate reader strengths where there is no loss in meaning construction. If a sentence is not semantically acceptable then it was not coded for meaning change and the coding notation is marked with a dash. Sentences with partial meaning change (YYP) and meaning loss (YYY, YN-, NN-) would indicate reader weakness and point toward a loss in meaning construction (Y. Goodman et al., 2005). Miscue patterns reveal a reader's language strengths and weaknesses (Y. Goodman et al., 2005). I did not look to compare the readers to each other, but rather analyzed each reader to see how they contribute to a better understanding of the case under study.

I cross-referenced all data and following a systematic data condensation, I completed a cross-case analysis to look for findings across groups of participants (Creswell & Poth, 2018). The combination of these varied data sources helps to increase validity and trustworthiness of the study.

Timeline for this Study

The timeline for this study began with recruitment in January 2021. Data collection subsequently ran from January 2021 through May 2021. I began with initial BRI's, completed in January 2021. Think alouds, oral readings, and RMA sessions occurred between February and March 2021. CRMA's began in March 2021 and occurred about every 3 weeks through mid-May 2021. Data analysis was ongoing throughout the study, starting with initial data collection. Writing and drafting of remaining chapters began in June 2021 and concluded in November 2021.

Limitations

This study was not without limitations, most notably the role I play as both the researcher and instructor. There was the possibility this would limit my potential sample, as students may not want to participate for a variety of reasons. I acknowledged this at the start of the project when I solicited volunteers and was respectful of their decisions. To avoid potential researcher bias, member checking and peer review were utilized. Another limitation was the short duration over which I conducted the study. The accelerated time line in completing the project may have limited potential findings as the data produced through CRMA and RMA is both rich and detailed, and I spent significant time on data analysis. The expected small sample size was another limitation, but any findings pertain directly to the group under study and any generalizations to other similar groups should be made with caution. Another limitation was having readers complete both the Think Aloud and the first Oral Reading sample on the same day. Participants completed their think aloud first and when they next completed the oral reading, each participant would tell me what they were looking at or thinking while reading to varying degrees. Another limitation in having adult learners read out loud is their awareness of my presence during the reading. Completing the CRMA sessions online using Zoom had distinct challenges related to connectivity. Finally, study findings are applicable to the MLS program included in this study and thus limits the generalizability of the study.

Trustworthiness and Validity

The varied nature of data analyzed for this project contributes towards this study's trustworthiness and validity. All study participants knew me prior to the start of the study and I had a good rapport with each reader. I maintained full disclosure with all

participants about the purpose of my research. This rapport and disclosure enabled a

high-level of comfort by my readers to participate and provide honest and open

reflections (Creswell & Poth, 2018). Throughout the process I used member-checking

with participants to verify developing findings (Creswell & Poth, 2018; Hesse-Biber,

2017). Presentation of findings includes rich, thick descriptions of data as way to ensure

validity (Creswell & Poth, 2018). I utilized multiple sources of data collection, as

described above, to triangulate data thereby ensuring trustworthiness of findings

(Creswell & Poth, 2018). Marking the typescript follows a systematic format which

reveals both simple and complex miscues and has been well validated (Murphy, 1999). I

further triangulated data sources using audio and video recordings to increase study

credibility (Hesse-Biber, 2017). Peer review was done recursively throughout the study

as means to help prevent researcher bias (Saldaña, 2016). I worked closely with my

dissertation committee chair throughout study design, data collection, and data analysis

adding to credibility (Yin, 2018). I also maintained an audit trail throughout as a way to

document my reflection and strategic choices for further data collection and analysis

(Creswell & Poth, 2018).

Ethical Considerations

I obtained IRB approval from the university and informed consent was given by

all participants prior to participation. After students agreed to participate, they were

informed that they could withdraw consent and leave the study at any time without

consequences. Students were reminded that this study had no bearing on their grade for

my hematology class in which they were enrolled, or any of their other MLS courses.

Exams and quizzes for the hematology course were multiple choice, matching, and

true/false, removing any subjective grading favoring participants. Laboratory evaluations were based on rubric-created assignments, again eliminating subjective grading favoring participants. As my role in the project was both instructor and researcher, the ethical considerations for my participants were foregrounded in project design and analysis: ensuring their participation was voluntary and not felt to be coerced, ensuring their confidentiality and well-being, and assuring appropriate boundaries in my roles as both their instructor and the primary researcher (Creswell & Poth, 2018; Hesse-Biber, 2017). All aspects of the project design reflect a conscious attempt to uphold these considerations.

A risk for participants was the loss of time by participating in the study. I was mindful of this time sacrifice in all participants' busy schedules and did not keep them longer than necessary, and they were reminded at each phase they could stop and withdraw consent without harm. To maintain participant confidentiality, all names used were pseudonyms (Hesse-Biber, 2017). Additionally, all electronic data was collected, stored and analyzed using secure connections. Each time I met with participants I reminded them of the purpose of the day's activities and allowed time for questions. I gave each reader clear directions about their tasks for the session (Y. Goodman et al., 2005). Participants had the option to view findings from the study after each phase of data collection, during the writing up of findings, and at its conclusion to ensure accurate representation of participants through member checking (Creswell & Poth, 2018; Hesse-Biber, 2017).

CHAPTER 4

FINDINGS

Introduction

I was able to gain insight into how one MLS community of college students, ascending professionals, and faculty professionals co-constructed disciplinary literacy knowledge through their dynamic transactions with disciplinary reading. This MLS community positioned their disciplinary reading as a co-constructed collaborative process that both fostered the development of college students into the MLS disciplinary literacy community as well as supported the professionals as they apprenticed these college students. Four themes emerged following multiple cycles of data analysis: (a) a developing awareness of the MLS disciplinary reading process, (b) learning and self-reflection as a MLS disciplinary reader, (c) the co-construction of disciplinary literacy knowledge as a community of MLS learners, and finally, (d) apprenticeship of college students into MLS disciplinary literacy practices. I begin with a description of how participants collectively discovered the value of comprehension when reading through Miscue Analysis and were able to come to a shared understanding of the MLS disciplinary reading process.

What follows is a description of how participants reflected on their disciplinary reading and then a portrayal of how this MLS community was co-constructing disciplinary literacy knowledge. During each CRMA, participants actively reflected on miscues made during oral readings and through their positive exchanges and encouragement of each other demonstrated how they were co-constructing disciplinary literacy knowledge. It was through this newfound community, participants were able to

step outside their self-described comfort zones and shift their perspective on the benefits

of group learning with CRMA. Finally, as the CRMA sessions evolved, participants

collectively came to identify the importance of apprenticeship into disciplinary literacy

practices as necessary to the development of MLS college readers' disciplinary literacy

knowledge.

Demystifying the MLS Disciplinary Reading Process

Throughout this study participants had multiple opportunities to both individually

reflect on the MLS reading process as well as collaboratively share their understanding of

MLS reading. Below is a description of how this MLS community, comprised of faculty

professionals, ascending professionals, and current college students, came to understand

disciplinary reading and demonstrations of them enacting disciplinary reading in process.

Initially, participants described common reading strategies such as rereading, sounding it

out or breaking it down, highlighting a reliance on the graphophonic language cueing

system (Y. Goodman, et al., 2005). However, through further group interactions during

CRMA sessions, the importance of various socio-cognitive reading strategies came to

light, and participants developed a greater appreciation in using all language cueing

systems (syntactic, semantic, and graphophonic) when reading disciplinary texts as a

means to support the co-construction of disciplinary literacy knowledge (Y. Goodman et

al., 2005).

Processes of Valuing Comprehension in Disciplinary Specific Reading through CRMA

Readers identified their purpose in reading as being a meaning-making endeavor.

Comprehension, while not always stated as a goal of their reading, was shown through

participants' readings and group interactions as vital to disciplinary reading. This awareness for the value of comprehension when reading was brought to light for many of these readers through group interactions during CRMA sessions. During each CRMA session, participants from all three groups had an opportunity to engage with each other, not only to discuss miscues made during oral readings, but in workshop sessions aimed at bringing awareness to the MLS disciplinary reading process.

Collaborative Discovery of the Literacy Benefit of Miscue Analysis by Learning about Comprehending in Process

The first CRMA session included just the three faculty professionals as an introduction to CRMA and an opportunity to practice prior to engaging with other participants (see Table 5). I wanted the faculty professionals to work with me to mediate the ensuing CRMA sessions and help guide ascending professionals and college students to consider the why behind their miscues at the same time considering their readings from a disciplinary perspective. I wanted to help them shift student thinking of disciplinary reading to focus on meaning construction by considering the reasons behind their miscues.

During this first CRMA session Bethany, one of the faculty professionals, clarified what her role would be "do you want it to just be really organic or are you wanting us…as facilitators slash participants, is there something you're really after getting them to at least think about, not necessarily to say, but at least address." I was able to stress to the faculty professionals the importance of discussing why miscues are made to provide insight into how each reader was making meaning while reading (Y. Goodman & Goodman, 2013), specifically from a disciplinary perspective. Each of the

faculty professionals also identified a goal they had as professors for participating with

students in CRMA sessions. Bethany wanted "to get more confidence about when it's

okay to just ignore a miscue versus when I might need to intervene." Zoe identified

"understanding where and how they're doing the miscues, what's the context of it…is it

the knowledge bases are missing." Mona noted distilling down to "when does it impact

the understanding of the information." Their focus was clearly on helping students better

understand MLS disciplinary content and texts. They all were excited for what they could

learn from students and how CRMA could impact them as teachers.

　　I introduced CRMA to each of the Teams and everyone had a chance to listen to a

short recording of my own reading of a hematology text. I purposefully used my own

reading as an example to demonstrate both the process of Miscue Analysis and provide a

level of comfort, especially for the students, that everyone makes miscues. I was going to

make intentional miscues when I was reading to use as an example, but did not need to do

so, as I invariably made miscues without trying. I highlighted this point to everyone

during our workshops, miscues are a normal part of reading and provide insight into how

a reader understands a text (Y. Goodman & Goodman, 2013). This gave all participants a

chance to listen to my oral reading at the start of the second CRMA session and discuss

how it differed from the printed text. Team A met regularly on Saturday mornings and for

the second CRMA session the group consisted of Bethany (a faculty professional), Lailah

and Violet (ascending professionals), along with Max and Rylee (college students). The

Team used a portion of my own reading (see Figure 1) to start the CRMA discussion.

Figure 1

Meghan's Substitution, Omission, & Insertion Miscues

Note. From "Erythrocyte Morphology and Its Disorders" (Adewoyin, et al., p. 5).

During Team A's discussion of my oral reading there was an initial focus on just finding what was different between the printed text and my reading:

> Max: Well, the biggest thing I noticed was you slow down your pronunciation of
>
> hemoglobinization…
>
> Violet: I noticed that you – down on the second bullet, said *iron deficiency*
>
> *anemia*, when the word *anemia* wasn't there.

These initial responses show how group members were warming up to the idea of discussing what was done by a reader during an oral reading. They focused more on simply picking out miscues without discussing why they were being made.

Bethany helped to change the course of the group's discussion by adding how I was working to make sense of the text. She noted, "it seemed to me that you were correcting the subject verb agreement. So, *teardrop red cells result* is what I think you said, but it says *results*, so there's a subject verb agreement there." This subtle move by Bethany had the effect of encouraging the group to start thinking more about why a miscue was made as it relates back to a goal of comprehension when reading. Bethany's comment exemplified how she was able to help the students start to shift their reflections on the reading process from a focus on accuracy to comprehending.

Following the discussion of miscues made during my short oral reading, Team A's CRMA session moved on to analyze and discuss Bethany's oral reading. The original text (Virk, et al., 2018) with Bethany's substitution of *damage* for *drainage* and immediate self-correction was discussed (see Figure 2).

Figure 2

Bethany's Self-Correction Miscue

A follow-up magnetic resonance image (MRI) scan

C damage

showed extensive venous clot impairing drainage,

venous infarct, and hemorrhagic transformation.
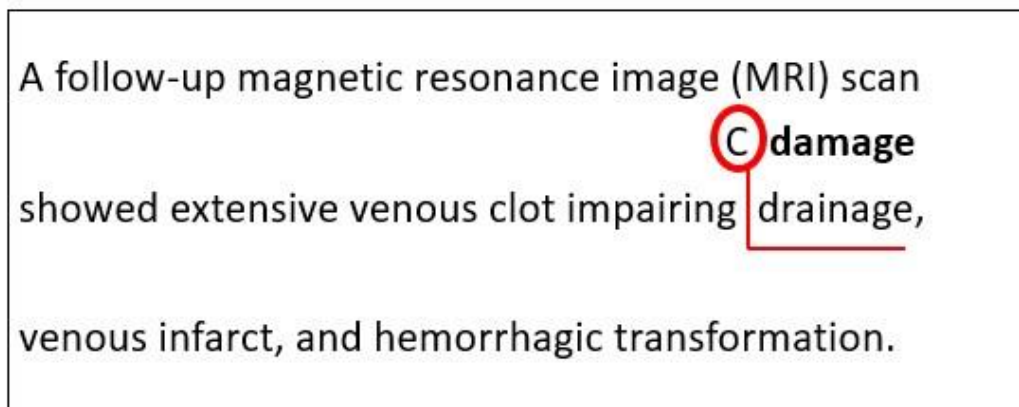
Note. From "Severe Underestimation of Serum Na following IVIG Treatment" (Virk et al., 2018, p. 372).

Max was the first to comment. He immediately picked up on the idea of considering miscues for what they revealed about how Bethany was working to make sense as she was reading. He considered her substitution of *damage* for *drainage* and subsequent self-correction. Max recognized the article was referencing a clot in the brain which could cause damage. He noted Bethany likely made this prediction when she read the text. This shows how Max considered Bethany's meaning making processes while reading. He was not just pointing out a substitution she made. Max demonstrated his own insight into how, as Bethany read, she made a prediction that she disconfirmed, she went back to correct and confirm her understanding, before progressing with her reading. Bethany's miscue demonstrated how she was able to monitor her understanding as she was reading and make corrections as needed to support her comprehension of the text she read. Max's analysis of her reading showed how he made his own disciplinary prediction based upon Bethany's reading. Through miscue analysis Max was able to not only see how others were reading, but also think about how he would process the text for comprehension.

Team B's second CRMA session included Mona and Zoe (faculty professionals), Darrin (an ascending professional), as well as Mary, Norma, and Logan (college students). Similar to Team A, during Team B's initial discussion of miscues from my oral reading (see Figure 1) everyone was rapidly listing my miscues they heard without considering why they were made:

Mona: I heard a couple of omissions…

Darrin: Yes. I think I heard instead of *target cells*, I think it was just *targets*…And

then there was also an insertion after, I think it was *iron deficiency anemia*

or iron – I'm not sure on that – I only heard it the second time, I didn't

hear it the first time for some reason.

Mary: I don't know where it is, but instead of *bull eyes*, you said, *bulls eye*…

Norma: I noticed that you didn't read any of the other parentheses, except for the

hyperchromic bulls eye.

During this exchange a number of my miscues were pointed out. I followed this exchange

with a brief description of why I made some of the miscues, pointing out how I was

making them in an effort to have the text make sense to me as I was reading. This

introduction to the process and understanding the notion of miscue analysis was not

simply identifying where the oral reading differed from the printed text but considering

why those changes were made, was paramount to everyone effectively discussing

disciplinary miscues. Like Team A, I first used the faculty professionals' oral readings to

continue the CRMA discussions, and Mona's reading of a microbiology text (Flayhart,

2020) went next (see Figure 3).

Figure 3

Mona's Substitution Miscue

For example, the WHO said 8 percent to 65 percent
                    UTI's
of urinary tract infections are not treatable with a

regularly prescribed antibiotic.

Note. From "New tools combat a complex antimicrobial resistance problem" (Flayhart, 2020, p. 8).

When Team B next turned to Mona, a faculty expert's reading, Norma was the first to identify a miscue and she immediately considered the why behind the miscue:

I noticed that, instead of saying *urinary tract infections*, you said *UTI* and I was able to understand what you're saying with that…I know what a UTI is just from class, but I guess that just kind of comes with experience, you automatically default to that.

Norma noted a substitution made by Mona, stating *UTI* for *urinary tract infections*. Norma did not just call out the miscue, but considered Mona's disciplinary experience as a basis for the miscue. Norma noted how she was able to immediately understand the substitution, given her own exposure to the terminology and abbreviation through her MLS classes. This disciplinary substitution demonstrated how Mona used her awareness for both the syntactic and semantic language cuing systems (Y. Goodman, et al., 2005) to

make sense of the text as she was reading, and how Norma had a similar awareness to be able to understand Mona's miscue.

Reader Engagement in Breaking the Illusion of Reading. I included a workshop where participants read and then discussed the short text *Boat in the Basement* (K. Goodman et al., 2016; see Table 5). Ken Goodman created this one paragraph text with multiple embedded grammatical errors present, for example, a *boat* changes to *boot*. I used this text to demonstrate how readers perceive a text and how they use their understanding about language and reading strategies to make sense of the text (K. Goodman et al., 2016). I asked all participants from both Teams to read the *Boat in the Basement* without going back and rereading it. We then discussed what they remembered from the short story.

All participants were quick to recognize something was off, noting how it was hard to not go back and reread. Bethany noted, "my instinct was to go back." As each participant was reading the text, the meaning they were creating was being lost. They integrated their socio-cognitive reading strategies to make predictions for the text and subsequently disconfirmed their predictions based on the embedded errors in the paragraph. This urge to go back demonstrated to everyone how they were actively making these predictions for the text based on how they expected the text to develop. These predictions were based upon a desire as the reader to make sense of the text they were reading. As their predictions were not confirmed, meaning was lost, and the inherent urge to make sense of the text was causing each reader to want to go back in their reading.

With further reflection on the text, Violet noticed how the text changed. Darrin also noted "I went straight forward until it said *boot* and then I was like, wait a second, that's not what we were talking about. I have to go back and reread that sentence again, and I realized things were changing." Mary noted how she had a bad feeling as she was reading and lost her focus due to the changes in the text. Everyone noted how the text was not "right" and through our conversations, all participants had a shared experience in breaking the illusion of reading as being letter by letter, word by word (K. Goodman et al, 2016). This activity motivated all participants to consciously start thinking and talking about socio-cognitive reading strategies they use while reading. Each participant acknowledged they made predictions for texts they read and were monitoring their reading process with a goal of comprehension.

Lailah, an ascending professional, made this connection when discussing Rylee's oral reading following the *Boat in the Basement* (K. Goodman et al., 2016) workshop during Team A's third CRMA session. The text Rylee read (Flayhart, 2020) had misspelled the family of bacteria *Enterobacteriaceae* as *Enterobacteriaeae*. During her oral reading, Rylee slowed down her reading when she came to this word, she produced the word correctly, and then took 2 seconds before continuing her reading. Lailah noted how Rylee was able to anticipate the word despite the typo. Lailah noted, "I didn't see it when I was going through it. I think it's just an omission of the 'c', and…we're so familiar with that word. Like one missing letter doesn't change what it looks like." Rylee noted how she only looked at part of the word and knew what it was going to be. After our discussions surrounding the *Boat in the Basement* text, the group became aware of how they made predictions based on their expectations of the text. Collectively, Team A

created a concrete example of how Rylee used her disciplinary knowledge to make a prediction about the text and read for understanding, and did not look at every letter.

      Understanding Reader's Eye Movements with EMMA. I also introduced readers to eye-movement miscue analysis (EMMA) as an additional layer of insight in how a reader comes to understand a text. I showed short clips of oral readings of MLS disciplinary texts read by former students of mine from previous EMMA studies (East et al., in press; East, 2020). When I showed the first page of text from an article I had used, everyone on each Team discussed where their own eyes went to on the page. Norma noted she looked first at the picture, Violet stated she looked to the title, and Mary noted how she went "straight to the case presentation." I then presented them with a static image of all the eye movements from one of the readers overlaying that page of text. Max noted how the static image was hard to follow due to all the eye movements from the reader. I then showed a short video clip of the eye movements of the reader as they read that page of text and many were amazed. Mona responded:

> Before seeing this I would have thought that as someone read they were going in a very purposeful direction, very linear direction. But this is showing me that that's completely wrong. That we're taking in quite a bit more at one time than we realize, and we're not just reading along the text in a very linear – we're all kind of, all over the place.

This newfound awareness for how a reader processes the text in a non-linear fashion was something these readers had not previously considered. Norma had a similar consideration where she noted, "I don't realize I do that much when I read, because I always think it's just a linear process, but not in this case." Norma noted she previously

felt her own reading to be in a very straightforward manner, and upon seeing the active

nature of the eye movements as the reader transacted with the text, she began to

reconsider her own reading process.

Lailah also considered how the reader's eye movements showed how the reader

looked at the image on the page as they were reading. She added, "it seems like as the

text is being read that they're also looking at the picture…they've read something that

relates to the picture, and then they're referencing the picture, at least maybe intentionally

or unintentionally to help them understand." Here, Lailah felt the reader integrated the

image to help with comprehension. Her insight into the reader using the images either

intentionally or unintentionally is interesting and demonstrated an awareness of the

pragmatic language cuing system (Y. Goodman et al., 2005), where the disciplinary

images enhance the written text. Max and Rylee had previously participated in an EMMA

study with me and Rylee acknowledged just how complex reading can be:

> For me, I think it shows just how distracted we are while we're reading. Because
>
> you can see that they're off looking around, they're probably still speaking – if
>
> they're reading it out loud, but their eyes are constantly taking in something new,
>
> while their brain is processing what they read.

I had previously been able to discuss EMMA with both Rylee and Max through their

participation in a previous research study. Rylee was able to add her interpretation that as

the reader is reading out loud, their eye has already moved to a new part of the text. The

idea of considering where a reader's eye moves on the page was a new concept for most

of these readers.

We discussed a short segment of disciplinary text read that included an image from a prior EMMA study (East, 2020). In this piece the eye movements of the reader can be seen to go from the text, to the image, and then back to the text. As Lailah had noted above, this showed how the reader was using the image to help with comprehension. Max and Lailah further reflected on this:

Max: I think that kind of showed her prior knowledge. Where she knew what a target cell was, she knew what it should look like. So she went down to make sure that there was a target cell there before she continued her reading. I also think it's pretty interesting that she didn't look at cell number one, even though it's unusual, she went straight to the target cell and just skipped over it.

Lailah: I would say she's trying to be more concise, you know. Focusing on the things that are relevant then the things that are, I guess, irrelevant to what the article is talking about, she knows that she doesn't have to focus on as much.

This conversation demonstrated how Max and Lailah considered the reader's disciplinary knowledge as a factor in how they chose to transact with the text. This also showed Max and Lailah's own disciplinary knowledge, as they were able to make assumptions about how the reader integrated the image with the text to create understanding.

Norma, in Team B, similarly noted this emerging awareness about how eye movements play into reading comprehension, "I don't think I consciously look at images, if someone were to ask me, did you look at this figure, I'd probably freak out and be like no …but images are the first thing my eye goes to." She was profoundly interested in

discussing how readers would use images based upon eye movement miscue analysis.

After introducing EMMA, both Teams started thinking about what a reader's eyes would

be doing as they discussed their own readings. Aside from Max and Rylee, this was the

first time the other participants had encountered EMMA examples and had not

specifically considered eye movements in relation to reading, and how that could provide

insights into how a reader was creating meaning. Even without seeing his eye

movements, Bethany considered how Max's eyes looked ahead while he was reading:

> But it is interesting though, that while the words are coming out of your mouth –
>
> *patient's high bilirubin levels* – that it's coming out of your mouth, but your brain
>
> has already moved on to something else. Like you've looked ahead, and that pause
>
> to me is what says that. Which is fascinating when you think about it, that what
>
> can be coming out of your mouth is something different than what your eyes are
>
> looking at.

Bethany considered Max's strategic moves while reading. After discussing how eye

movements can provide insight into a reader's transaction with a text, she made her own

prediction about what he was doing while reading. Bethany, along with Mona, Zoe,

Darrin, Norma, and Logan, were quick to admit they would have loved to do an oral

reading while tracking their eyes to get a better understanding in how they were

transacting with the text.

Consideration of Comprehension when Reading

The final workshop completed by participants discussed retellings as a measure of

comprehension (see Table 5). Each reader was quick to acknowledge they did not always

reveal all they knew or learned from the text in their initial retelling (Y. Goodman et al.,

2005). For each of the two CRMA workshop sessions, Team A and Team B, I used one of the faculty's retellings to prevent students from feeling pressured by their professors hearing their retellings. Throughout, participants reflected on how variable a retelling could be based on level of experience, concentration of the reader while reading, even by how a reader was feeling at the time of the reading.

In Team A, Max was impressed by Bethany's retelling and related it to her experience, "you come across this often, so, it was easier for you to recall exactly what the problem was." Max felt the detailed way Bethany was able to retell the disciplinary article she read was due in part to her extensive knowledge on the topic to begin with. Lailah agreed that experience helped with a retelling, but acknowledged the challenge of reading out loud while trying to comprehend at the same time. She noted, "there's a lot more things you have to be mindful of, making sure that you're reading everything correctly, and that can also kind of compromise how your understanding the text as you read it." She acknowledged with reading out loud part of her focus while reading went toward how she was orally producing the text. By focusing on accurately reading the text out loud, she felt this negatively affected her comprehension of the text she read. She felt a retelling might "be constrained" based on where the reader was focusing their efforts during the reading.

For Team B, I used Zoe's retelling as an example for discussion during the fourth CRMA session. During Team B's conversation, Violet compared her own retelling to Zoe's, "my retelling was not this good because I was not used to the type of case study." She acknowledged how retellings could be based on the prior knowledge of the reader, someone with more understanding on a subject or even someone used to the format of the

article could provide a more in-depth retelling. Zoe recognized the level of experience of a reader could influence a retelling. She also considered the mode of reading to be impactful, silent versus oral. She reflected:

> I think it depends on the type of reading you are doing. Reading aloud – I think comprehension is lost because there is the performance aspect. I sometimes can glean information about what I'm reading – but if it really isn't in my wheelhouse, I probably would not understand it very well. Something that I do understand pretty well, I would probably get more out of even while reading aloud. If you are reading to yourself, though, there are opportunities to go back, re-read, and gain understanding by doing that. You can concentrate, process, and look up supplemental information if needed.

Zoe was aware the text was easier for her to understand and discuss when she already had a high degree of understanding about the topic of the text. However, she also noted with an oral reading came the feeling of performing, and she reflected how she was aware how her own reading style changed. She felt she should not go back to reread when reading out loud. This feeling of not being able to go back and reread when reading out loud is significant, as rereading a text can help to increase comprehension, and by not doing so, meaning may be lost and thus a retelling could be impacted.

Logan also acknowledged the difficulty of simultaneously reading out loud and comprehending after he heard Zoe's retelling. He felt most of his focus was on verbalizing rather than processing what he read. He noted, "for me, at least, I definitely retain a lot more, just reading it to myself, instead of out loud. So, it's kind of impressive that they would remember so much." Participants connected a retelling to the

concentration of a reader while reading as well as the prior disciplinary knowledge of the reader.

Rylee, on the other hand, internalized the retellings. During Team A's fourth CRMA session she stated, "I think it shows what was highlighted to us as readers instead of what was purposefully highlighted by the writers. Because we pick up things differently than how they wanted us to." This comment showed the value Rylee placed on her own interpretation of the text and viewed reading as a transaction between the writer, the text, and the reader. Rylee viewed herself, as the reader, an important component of the meaning-making process. Rylee's comment demonstrated her awareness that meaning does not reside only in the text, but how a reader interprets the text as well. Darrin, like Rylee, internalized retellings, "I think the retelling is a very interesting way to gauge how much I've absorbed while reading." Here, Darrin considered how a retelling can be used as a form of reflection about her own understanding after reading. She acknowledged the text as conveying information, and viewed the retelling as a way to demonstrate what she was able to understand from the text.

Violet went a step further to consider a retelling like a test. Coming from the mindset of a test, she felt the retelling to be her, "most nerve-racking and insecure part – because I would like to reread a text before I display my knowledge." Violet initially felt she was being judged based off the retelling and her insecurity about how she performed was under scrutiny. Mary added that "I think they can be difficult, especially depending on the piece and the way I feel that day. If the piece is not very readable, I will find it distracting and it is harder for me to recall details." Mary considered how she was feeling

as impactful upon what she was able to take away from a text. Mary and Violet

recognized that many factors could go in to how well someone understood a text. Both

were mindful that while a retelling can demonstrate a reader's comprehension of a text, it

is not all inclusive of what the reader came to understand.

Despite their awareness about the limits of retellings, participants saw the benefit

of retellings. During the final CRMA session, Darrin reflected, "I really enjoyed the

retelling portion! I think it could be used as a great study tool…even if someone doesn't

read aloud smoothly it doesn't mean they aren't absorbing the message and vice versa."

This newfound awareness of what a retelling offered, affirmed to Darrin that the reader

was at the center of understanding. She came to realize that a retelling is quite

individualized and she considered how it could be used in the future. Bethany considered

retellings to be a lengthy process but also realized their benefit, "I can see where it really

gives insight into how a reader processes information and how that contributes to what is

gained or retained and what is missed." Through group discussion these readers were able

to discover the literacy benefit of retellings for comprehension and how they could be

used in the discipline. They viewed the retellings as a way connect what they were

coming to understand in their disciplinary readings with broader disciplinary concepts.

These also felt retellings highlighted ideas which remained unclear and needed more

attention.

Understanding Socio-Cognitive Reading Strategies and Disciplinary Reading

Practices for Meaning Making

Most participants had a short, finite list of reading strategies they were able to

identify, see Table 7. While they may have named a short list of reading strategies, I saw

many socio-cognitive reading strategies that were being integrated, such as inferring, predicting, and confirming or disconfirming. College students and ascending professionals were not aware of their additional strategy use until we discussed them during their individual interviews with me and their group interactions during CRMA sessions. The ways in which these participants were enacting these practices, even subconsciously, showed a purpose of comprehension when reading.

Table 7

Faculty Professionals', Ascending Professionals', and College Students' Commonly Identified Reading Strategies

• break it down	• context clues	• look it up
• reread it	• Google it	• rephrase it
• sound it out	• repeat in my head	• annotate
• pre-reading	• not glossing over	• ask others
• skim the text	• ask for clarification	• skip it
• ask more questions	• pick apart the sentence	• using tables/figures
• consult other authors/references	• look at roots/prefixes	

Becoming Aware of the Benefit of Rereading

A common reading strategy both verbalized and then made by each participant during think alouds and oral readings was to reread the text. At times, what participants reread was a word, at other times it was a whole sentence or even a short passage. During Lailah's oral reading of a hematology text *Methods of testing platelet count and function* (Riley, 2020), she read with a very deliberate pace throughout and frequently reread words and even entire sentences as needed. One example of her rereading is the sentence described below (see Figure 4), which provided numerous points of discussion in

understanding the MLS disciplinary reading process both individually and with Lailah's

CRMA group.

Figure 4

Lailah's Repetitions, Pauses, Abandoning a Correct Form, Self-Correction, and Insertion

Miscues with Self Talk

Note. From "Methods of testing platelet count and Function" (Riley, 2020, p. 8).

        At the first thrombocytopenia, Lailah read *thrombo-* , then immediately self-

corrected to *thrombocytopenia*, and read the word correctly when it was printed the

second time without pause. By monitoring her understanding of the text, she can be seen

to make a prediction of the text, confirm, and continue her reading. After Lailah read the

first sentence, she had a 5 second pause and then stated "I'm going to reread that sentence

to make sure I understood it." When she re-read the sentence, she substituted *20* for *20.7*.

After she reread the sentence, she confirmed her understanding before stating "OK," and then proceeding with the text. During her RMA session, she noted "I realized the thing I need to understand is the second half of the sentence…I mean the number wasn't really the main point." Lailah was using all three language cuing systems to help her understand the text. She altered the flow of her reading, made predictions while reading based on her expectations for the text, monitored her reading process, confirmed she was understanding and continued her reading. She also tapped into her disciplinary schema for hematology by inserting the descriptor *platelets* in the second sentence. So, while simply rereading may not be an effective strategy use for long term text retention, her demonstrated ability to integrate the current reading with her prior knowledge on the topic is able to support her disciplinary literacy knowledge development.

As a commonly cited strategy used by participants, rereading can objectively show when a reader is monitoring their understanding. Discussion of this additional processing of text can bring an explicit awareness into how a reader is coming to understand a text. Team A's interpretations on how Lailah was coming to understand the text were expressed through their discussion during the second CRMA session of Lailah's rereading example noted above. An awareness of this importance of rereading to help with understanding was noted during the following exchange:

Max: What I thought was really cool was when she repeated the sentence from, *in a study from Wuhan*. When it says *20.7%,* she said *20.7%* the first time she read it, then the second time she only said *20%*. And I think that kind of condensed it to make it easier for her to understand. Because she got to

the second time she read it, and I, you know, 0.7% is negligible, so I don't think it really changed the meaning. But it did help her understanding.

Violet: Yeah! I really appreciate that miscue of her rereading the sentence. She was really not just reading that to get it out there, she was reading it to understand it. And yeah, she didn't make much – but a point seven mistake, and it did not hurt her understanding, and actually helped her repeat that sentence. I also liked that she put platelets- she inserted *platelets* as a unit for when it said zero to 50,000 *platelets*. It shows that she knew what she was reading, so that she could make her own unit. Even though they mentioned that they were talking about platelets, it showed up as comprehension.

Max: And I think that came from experience, too, because every time we see these values we see them, as you know, zero to 50,000 *platelets* per microliter.

Violet: Right!...

Lailah: With me rereading the sentence, I feel like that was probably, due to when you're reading out loud, you tend to just get lost in reading, word for word, and just forgetting, like, okay what does that actually mean, what I just said.

In this exchange Max and Violet discussed how Lailah's rereading was beneficial for her understanding. Lailah provided additional insight into her thoughts on the reading. Lailah's comment supports the notion that her purpose for reading was comprehension.

She was not going to settle with just moving through the text, but rather wanted to ensure she was understanding the text.

A little later in the conversation, Rylee circled back to the idea of Lailah repeating the sentence noted above. She added, "I love that sentence that she repeated…I liked the fluidity that she had the second time around… it showed that she was really understanding it the second time." Rylee noted how fluid the sentence became with the second reading. By rereading, Lailah had recognized what part of the sentence was important for her in her comprehension of the text at large, and was able to successfully continue her reading with confidence. Max, Violet, Lailah and Rylee's discussion demonstrated how they were able to collaboratively evaluate an individual reading and find value in determining what was important to focus on during a disciplinary reading for comprehension. By acknowledging how Lailah's comprehension benefited from rereading, these four participants showed how they were coming to revalue their own meaning making processes.

Prior Knowledge as Important for Comprehension of Disciplinary Reading

As seen in the previous exchange between Max, Violet, Lailah, and Rylee, the importance of prior knowledge when reading a disciplinary text was paramount to understanding what was read. Lailah demonstrated her familiarity with conventions of the MLS discipline when she inserted the word *platelets* after the platelet count in the second sentence. Violet and Max acknowledged this and connected Lailah's awareness of expectations for unit representation in the field as evidence of her comprehension of the text. Bethany confirmed this insight when she noted "where she inserted platelets and units, I think everybody said that that's sort of showing her disciplinary expertise, like,

that's what we all do." As a faculty professional, Bethany acknowledged and validated

these disciplinary funds of knowledge come about from experience. They were able to

recognize the importance of this inherent understanding of MLS disciplinary knowledge

as a significant feature necessary to understanding a disciplinary text. This elaboration

and integration of prior knowledge with a new text has been shown to increase

disciplinary knowledge (McNamara & Magliano, 2009). By having this tacit

understanding of how units are expressed in the field, Lailah was able to infer how this

count would normally be spoken and added an additional layer of clarity to her reading

by explicitly stating platelets.

All participants on both CRMA Teams discussed the importance of harnessing

prior disciplinary knowledge in their understanding of the MLS texts they read. During

CRMA session four, our discussions centered on the second oral reading samples

completed by each college student. I provided a copy of the text for everyone to read

prior to the session. This second oral reading was a chemistry case study titled *Markedly*

Elevated Indirect Bilirubin in an 11-Year-Old African American Boy: Normal or

Aberrant? (Chang et al., 2013). Mona, on Team B, reflected on her desire for more initial

patient information at the start of the case study. The case highlighted various forms of

bilirubin and Mona acknowledged by having focused on microbiology for so many years,

much of her chemistry knowledge was not as fresh in her mind. She noted it was

challenging for her to understand the text since she had not thought about this level of

detail in chemistry in quite a while. Logan thought it was interesting given Mona's

microbiology background that she wanted more patient history. As a student, Logan, had

recently covered the topic and added, "I read the title and I matched it up, so I skipped

over a lot of the background, because I just didn't feel like it would add anything to my understanding personally." Mona's prior knowledge on the topic was less recent then Logan's, and she had to work harder to understand the text given the background information provided.

In Logan's hematology class he had just learned about sickle cell disease and had just covered liver metabolism in his biochemistry class. He commented on this recent instruction during his retelling session with me following his second oral reading. Logan noted he expected to see certain lab results given the patient's disease and for him it was "a little easier to understand the text because I was familiar with the other three types of bilirubin. So, it was easier to kind of match up and correlate with the biliprotein." Here, Logan highlighted his predictions based on expectations from the text. Logan's preexisting schema was crucial to fostering his comprehension (Y. Goodman & Goodman, 2013) as he credits his understanding of sickle cell disease and how it relates to his expectations for chemistry values in a patient. He confirmed his predictions through his reading of the text and was able to understand the material more readily. He also noted how his current awareness about bilirubin metabolism made it easier for him to understand the new material presented on biliprotein, demonstrating his usage of schema-forming comprehension. He simultaneously was monitoring his existing schema as he was learning new information.

During Team B's fourth CRMA discussion, Mona brought forth the idea about the relevance of having to discuss a chemistry article with her being a microbiology professional. Each of the faculty professionals in the study acknowledged that their understanding of a text was inherently related to whether the text was in their specific

sub-discipline. Bethany, whose specialty was chemistry, noted, "so you had me reading a chemistry text, it would have been a different show if I'd been reading a hematology text! And it really would have been a very different conversation, depending on what you chose to give to me." Even though the faculty professionals are experts in MLS, their background disciplinary knowledge varied depending upon relevance to their stated sub-discipline. This expertise was important for them as professors, they had a vast amount of disciplinary knowledge and experience which they brought to the classroom.

After her oral reading Bethany highlighted the importance of her schema-driven miscues and comprehension (Y. Goodman & Goodman, 2013), explaining how much she had to use her prior disciplinary knowledge when reading and understanding a disciplinary text. During her retelling she noted the extent to which she added details beyond what the article had presented. She acknowledged the article assumed the reader would know enough about clinical chemistry to fill in some blanks. Given her disciplinary background knowledge, she was able to do so without difficulty. She acknowledged a novice might have difficulty understanding the same text. Bethany additionally reflected how a lack of prior knowledge can be challenging for students due to the gaps in their knowledge, "there was an assumed amount of knowledge there, which is appropriate for disciplinary texts. So, for students, I think some of those assumptions were beyond where they might be. And I would even say for new grads." Bethany was quick to note for graduates they had a lot of information thrown at them during their schooling and the gaps were likely due to lack of experience in the field, "is it really part of their true disciplinary background? No, I think that evolves." Bethany was very

practical in noting how disciplinary experience tied into reading comprehension in the discipline.

We discussed these inherent assumptions of a reader's prior knowledge throughout the study. Max, in support of Bethany's comment about having a lot of knowledge thrown at them, acknowledged his own level of experience related to his reading "as you know, I'm not the best at coagulation, so it's more that these words were familiar…something I'd have to review, but I know that they all play parts in the coag pathway." Max was cognizant of the challenge of learning so much information, but was able to consider the benefits to him as a student to integrate his prior disciplinary knowledge when trying to understand the hematology text he read out loud. He noted, "if I hadn't been in the MLS program, I would have had no idea what the GP - what the heck glycoproteins were, or I wouldn't have known what von Willebrand's factor was. I would have been very lost!" So, while he noted how challenging it can be to navigate the disciplinary texts in his MLS program, he was also able to appreciate how they were helping to develop his disciplinary literacy knowledge.

Disciplinary Specific Terminologies for Comprehension

During each CRMA session, faculty professionals, ascending professionals, and college students frequently referenced the importance of understanding vocabulary unique to the profession as crucial to understanding disciplinary texts. In this MLS program, medical terminology is inherently taught as it relates to concepts covered. Students understanding of the conventions for medical terms and words as tied to larger concepts was central to understanding texts read.

Lailah read a hematology text (Riley, 2020) which discussed platelets and platelet counts. The medical term for platelets is thrombocyte and the root word is thrombo-. When referencing high cell counts, the suffixes -cythemia or -cytosis would be used, while for low counts, the suffix -cytopenia would be used. As Lailah read, she was deliberate in her reading, paying careful attention to which word she was saying, as interchanging the suffixes can quite literally mean the exact opposite concept, elevated platelet counts versus low platelet counts. In the following sentence (see Figure 5) Lailah phonetically produced *thrombasthenia* as *throm/bas/thenia*.

Figure 5

Lailah's Articulation Related Miscue Indicated by Two Vertical Lines

Platelet counts within the normal range are critical to

maintain blood fluidity, together with a functional

coagulation pathway, but functional deficiencies of
"Um"
platelets can also occur, called thrombasthenia.
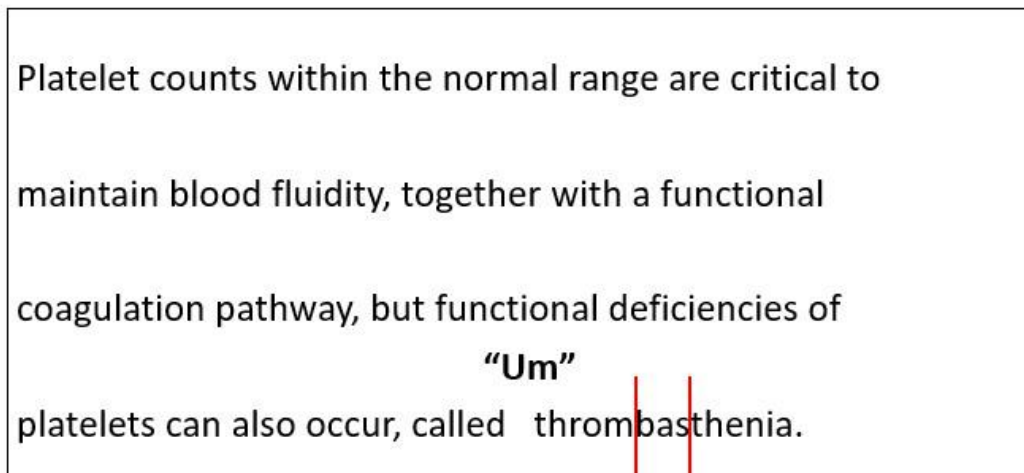
Note. From "Methods of testing platelet count and Function" (Riley, 2020, p. 8).

Prior to saying thrombasthenia, Lailah briefly paused and said "Um." Lailah's oral reading and how she navigated this term was discussed during Team A's second CRMA session:

Bethany: I thought where she tripped over thrombasthenia, that she was – because

what I would have done, and maybe I'm projecting, is that you're used to

seeing thrombocytopenia or thrombocytosis. There's lots of words that

begin with thrombo-, but thrombasthenia is not as commonly used. So, I

feel like it tripped you because it was not – it was not what you expected.

You saw the first part of the word, expected something different at the

end.

Lailah: I think this article is a lot of thrombo's. Just like a tongue twister the

whole way through…

Rylee: But I also loved her use of "um" and "ah" as a placeholder, because

usually, it was right before words that would need a little bit of thought

process. To understand like how to say them out loud, just because they're

not words that we usually say out loud.

During this exchange, Bethany acknowledged how careful Lailah had to be while reading

to ensure she was understanding the text correctly. Bethany added how Lailah was having

to make predictions while reading to understand the text and then confirm her predictions

as she read. Rylee provided additional insight into Lailah's meaning-making strategy

with her usage of "um" while reading to slow her reading down and give her the

opportunity to make a prediction about the text, and then confirm her prediction before

moving on. Bethany provided further insight into the dynamic nature of her own

disciplinary reading. She noted "I know enough roots and prefixes…I try to break it

down, or get it from context," adding she would stop and look up words as needed if she

felt her understanding was impeded by her missing the meaning. Bethany's comments

effectively summarize the fluid nature of the reading process and how she, as a member

of this MLS community used a variety of socio-cognitive reading strategies to effectively and efficiently garner meaning from a disciplinary text. Even though she never specifically noted using all the language cuing systems, her comments demonstrate how she used them in practice.

Reflections on Using "Google it" in Disciplinary Reading

Many reading strategies identified were common across participants. As reading progressed, monitoring for understanding and flexibly adjusting strategy use was apparent in these readers as noted by Bethany above. One of the main strategies vocalized by everyone, regardless of level of experience, was to Google information that was unclear or for definitions they did not understand. As a student, Rylee noted, "if it's a word that I just don't understand the meaning of, I will usually Google it." Similarly, even as a seasoned faculty professional, Mona reflected she used Google for words she was unfamiliar with as well as a resource to help in her understanding. These comments highlight how participants utilized the semantic language cuing system with a desire to have their reading make sense. Participants noted if their lack of understanding for a word or topic affected their understanding of the larger concepts being read, they utilized other resources, specifically Google. They demonstrated how their focus on comprehension while reading.

Norma admitted she would use Google if she was unable to gather meaning from the text "usually I try to guess the meaning of the word, like context clues, or sometimes I just Google it." Norma verbalized how she would monitor her reading and would change reading strategies as needed, moving from utilizing context clues to searching out additional resources as needed to understand what she was reading. Additionally,

following Norma's oral reading, I asked if there was anything she would have done

differently with her reading if she had not been reading out loud in front of me. She was

quick to note that she would have Googled definitions and concepts to help her

understand the text while reading. She did not do this during her reading as she thought

she had to keep reading without stopping.

During his think aloud, Max actually did just that. He stopped his reading and

turned to Google and laughed as he read additionally for clarity:

So, in this text they talk about how lymphocytes express the ACE 2 receptors on

their surface and I'm - I haven't really read that anywhere else. So, I'm going to

Google more about that to get a better idea of the ACE 2 receptors…And I'm glad

I did, because I learned that the ACE 2 receptors are the receptors that the COVID

virus attaches to.

Max completed his think aloud with me via Zoom and subsequently read his self-selected

MLS text from his computer screen. This enabled him to easily access the internet to

rapidly search for information that was unclear as he was reading. Max demonstrated

how he made a prediction about what ACE 2 receptors were in relation to the article he

was reading, then disconfirmed his prediction and used other resources to gain meaning

prior to continuing his reading. Bethany was acutely aware of student's frequent usage of

Google and noted, "I can see a student that has never been instructed on ROC curves

feeling very frustrated and having no idea what that meant and I would say, Google, like

right at the top." Here, Bethany acknowledged a student might use the Google search

engine to help understand how to read a frequently used chart in the MLS discipline.

Using Google as both a named and practiced reading strategy demonstrated how each

participant was prioritizing comprehension while reading. Whether or not participants acknowledged a goal of reading to be comprehension, they showed an awareness for this by monitoring their reading process and were cognizant of when meaning was unclear (Cho & Afflerbach, 2017). They readily attempted to determine meaning of words through context, recognized when meaning was critical to comprehension, and worked to actively clarify meaning.

Participants with all levels of experience were not troubled by their individual usage of online resources, specifically Google, in their disciplinary readings. Norma felt it increased her disciplinary knowledge by enabling her to add to what she was reading. However, she acknowledged if she turned to the internet for clarification, she had to be careful not to get distracted. Violet added she felt it important to ensuring her understanding of texts to be able to find rapid answers to her questions. As noted above, Bethany confirmed to her Team her own usage of Google and her recognition of students' usage as well.

However, simply turning to Google may inadvertently be pushing students into thinking of reading as an individual activity. When considering their disciplinary reading, few participants noted they would ask for clarification or ask others if they had trouble during their reading. As adults in a college disciplinary setting, they have become conditioned to view reading as an individual process, only seeking out assistance from someone when they are unable to gather meaning on their own. As a faculty professional, Zoe postulated students may:

just try and slam through it, whether or not they understood the reading or not,

and then probably come and ask questions – maybe. I don't know if they're

sophisticated enough necessarily in their reading to know what they don't know!

Zoe recognized each student was different in how they would approach their disciplinary

readings and subsequently ask for help if needed. Zoe's concern was students would read

their disciplinary texts and not fully understand them, but then not seek out assistance

with their readings because the student did not have the level of disciplinary knowledge

to make broad connections between their disciplinary texts and disciplinary content.

Zoe's concern was by having students so readily use Google to help with their readings

they may also get incorrect content. She was worried they would be learning the

disciplinary information wrong, and that could affect their understanding, their course

grade, and even their ability to pass their national certification exam after graduation.

By not discussing their individual understanding of a reading, students may feel

additional pressure to get it right. After discussing readings during the CRMA, Rylee

noted she no longer felt behind her peers and felt she was on the same level as the other

students. Darrin added she felt less isolated in her reading by seeing where others were

similarly struggling with their reading. While the internet provided the ease of quickly

answering questions when reading, the ability for novices to fully understand complex

disciplinary texts may not be entirely realized without considering reading beyond the

individual level.

Appreciating the Multimodal Nature of Disciplinary Texts

An additional disciplinary reading strategy that was prioritized by faculty

professionals and ascending professionals compared to college students was the

integration of various multimodal features of disciplinary texts while reading to enhance comprehension. Zoe noted the table presented in the transfusion article she read aloud was helpful to her understanding the text. During Bethany's think aloud she noted, "flipping back and forth between tables and figures, that's integrated reading for me. That's not one and done…. I will go back and forth between texts and figures and tables." Bethany saw the text and images not as separate events but as integrated parts of a whole. She reflected as she read, "if the table or the figure, seem relevant, my eyes are going back and forth between those two things to try to put them together." Bethany's holistic incorporation of the multimodality of a text aligns with previous descriptions of semiotic usage in science texts presented by Lemke (1990, 1998) and Kress and van Leeuwen (2006).

Violet appreciated having images with her disciplinary texts "photos are nice, though, because some things do need a visual explanation, like cellular morphology." This importance of integrating the multimodal nature of the disciplinary text was evident during Lailah's think aloud:

> I'm reading this and it said the white counts increase, and I think I might have - okay yeah, I missed that one on the table. So, I just went back to look at it…. Okay, so I see the pictures as well. And then just re- I've read a little bit of the diagnosis, and they said hereditary elliptocytosis as an incidental finding. So, at first, I was like hmm, how'd they diagnose that. Then I see the pictures and how, you know, the smear is majority elliptocytes. That makes sense, with the diagnosis.

As Lailah read through the text, she was utilizing the images to foster her understanding of what she was reading. She, like Bethany, was using the images in a very integrated method, flowing back and forth between text and image as needed to understand the text at large.

The college students did not consistently integrate the images or tables while reading. However, a few of them did use the various multimodal aspects. Rylee noted the figures helped her understanding "it helped me visualize what their PCR results were, how they were coming to the conclusions that they were. And then the tables helped to also, in a way, give me a visual of the data that they were describing." But not all the students prioritized the multimodal aspects similarly. Max admitted he skimmed over the image during his oral reading and Logan acknowledged that he preferred text to pictures and tables. After his oral reading, Logan stated he "did not think the picture was relevant in understanding the case study so I skipped it," and noted he did not look at the table. Logan's views and usage on the multimodal aspect of MLS disciplinary reading stood in stark contrast to the holistic interpretation Bethany had on using multimodal features.

The college students as a whole did not prioritize the multimodal nature of their disciplinary readings. They saw them as a repetition of the text and unnecessary for comprehension. The ascending professionals showed more attention than the college students to the role multimodality played in their understanding of disciplinary texts. They frequently noted how they incorporated both to enhance their understanding. The faculty professionals' perceptions on multimodal features were consistent with Bethany's holistic interpretation and showed the value they had in relation to their disciplinary reading.

Recognizing Individualized Connections as Influential on MLS Disciplinary Reading

Each reader was given the opportunity to self-select a MLS disciplinary text for their think aloud and select one of two options for their oral reading. College students all completed a second orally read text that I selected. By providing each reader with the opportunity to select a text, their personal motivations for reading the text came to light. Each reader was able to highlight the importance of the reading to the MLS discipline. By doing so, the individualized nature of MLS text selection for their disciplinary reading became apparent.

I asked each reader how they defined disciplinary reading in MLS. The faculty professionals felt disciplinary reading to be texts written by their peers for their peers. They also felt the readings had to pertain to the field broadly and should be purposeful in order to gain knowledge. The ascending professionals similarly recognized disciplinary reading as anything pertaining to the profession. They were aware that disciplinary reading could take many forms and were open to these various modalities available and how the MLS chose to pursue those readings. These statements acknowledge disciplinary reading to be purposefully driven. Students, on the other hand, took a different perspective on answering this question, frequently citing sources of disciplinary reading as being textbooks, case studies, and research articles. These differences in perspective about disciplinary reading can be tied to experience in the discipline itself. The students have not had the experience in the discipline and thus far their only personal experiences are from a classroom setting.

Despite the differences in how each group approached disciplinary reading, everyone acknowledged motivation as influential on their selection of reading. Max recognized the importance of purpose when considering how he would read a text, while also acknowledging how he adjusts his reading within a text as well:

> I only like to read stuff that I believe is relevant or interesting. So even if it's in one article, and I find something that's kind of, you know, not as important or not as interesting to me, I just skim over it, as opposed to reading it with detail. But if it's something that I find really interesting, then I read it with exquisite detail and I reread it.

Max was aligning his own interests as motivational for not only reading a text but also how he read the text. Max selected hematology as the text he would read out loud. This was because at the time of his reading he was getting ready to start his three-week hematology clinical rotation and wanted to review that subject. He was also working on drafting a case-study write-up as a graded assignment for his clinical rotation and selected the article for his think aloud "because it pertains to one of my case studies." This internal motivation was a strong influence on him both selecting the text, reading the text, and then evaluating its relevance for him in relation to his own personal disciplinary literacy knowledge.

Mary had similar internal motivation with personal interest guiding her selection of text she used during her think aloud:

> I was always super interested in this particular parasite. Because in lecture we were told that it was common in Scandinavian countries where they make – they pickle their fish. And my family is from Norway and there is a dish that's made

just like that, and I was, I always thought about this. So that's the significance of that parasite for me.

While Mary readily acknowledged her own interest in relation to her selection of disciplinary text, it can be challenging across the various disciplinary readings to garner student interest in disciplinary reading. Logan noted he "was trying to find some type of blood bank related case study because that's what I'm interested in and comfortable with." He acknowledged he wanted some level of familiarity for the text he selected in addition to his personal interest.

As a professor for many years, Bethany recognized that for students it may be difficult for them to have internal motivation outside of personal interest when reading. She also felt students needed some form of accountability with their disciplinary readings. Bethany recognized she needed to build purpose into her reading assignments and structured them accordingly. She noted she might assign questions for students to answer based off a reading assignment, or highlight how concepts related to a lab session, or even simply telling students there would be a grade attached to the reading. She continued:

> I think you read differently, based on your purpose, so a student would approach it… So, let's say that the student had the task of answering some questions I had - they're not gonna read it, they're going to try and hunt and peck. They're going to look at the question they have to answer, and I think they're going to try to hunt and peck in there. How to answer the question as opposed to actually reading the darn thing!

 She was cognizant of students' limited time and the overwhelming nature of some of the readings. She carefully selected texts for them with this in mind. She knew the MLS texts used in the program were challenging, but felt them to be an important and helpful long-term resource. Bethany was purposeful in her structuring of reading assignments to provide guidance for students as a way to highlight the key aspects of their disciplinary texts she felt, as an expert, were important for them to understand.

Learning from a disciplinary text was a strong motivator across all three groups of participants. Students main purpose with any of their disciplinary readings was to learn new MLS disciplinary concepts or to enhance their current understanding of MLS disciplinary concepts. Violet also noted how she was able to appreciate the article she read for what she could learn from it, "that is a new concept to me – well, no, the pseudo hyperkalemia is not, but the reverse pseudo hyperkalemia is new to me." She noted after her reading that she was going to read back through the article to ensure she understood everything correctly and was even going to take it to work to show her colleagues. Even as a faculty professional, Mona also noted how she valued what she could learn from the disciplinary text she read, "the relationship with rhinovirus and asthma – I didn't really understand a lot about that…it helps fill in some gaps for me." Mona commented she would frequently use disciplinary readings to learn new information and felt that to be a strong motivator to read a disciplinary text.

Connections between disciplinary reading and the MLS experience

All readers from each group identified connections between the MLS texts they read in this study and the MLS experience. While those with experience could tie reading directly to past MLS experiences, others identified when a reading held relevance to them

currently for what they were learning, or even the potential for future experiences. As

each participant read the various disciplinary articles for this study, they frequently

considered how the article related to their current position as an MLS, either as a student

or working in the field. Rylee noted the reading "helped me to understand more of the

public relations side of our discipline," something she had not previously considered. For

Mary, her readings reaffirmed to her that she was in the right field "it's confirming to me

that this is what I want it to, and that this is what I like." Their readings helped them to

feel more connected to the MLS discipline as well as have a greater appreciation for the

MLS discipline as a whole.

     Disciplinary reading took many forms in the eyes of these participants. As the

students mentioned, textbooks, journal articles, and case studies were frequently cited

disciplinary readings. Across the board, though, participants readily acknowledged

procedure reading as inherently disciplinary. Violet noted "I'd actually also say standard

operating procedures would be considered disciplinary reading." Mary agreed and felt the

procedures helped her not to feel overwhelmed when looking at the instruments in the

lab. But she also noted the procedures could be challenging, "I think just the

formatting…just kind of freaked me out before I even got into it. And I would just be

like, what do I need from this and where do I find it." Mary's comments show the value

she placed on understanding procedure manuals to the discipline while also

demonstrating that as a student they can be challenging when trying to navigate them

individually.

     Max, at the time the study began, had just started his clinical rotations and

considered how his disciplinary reading would likely change after graduation from being

primarily textbook-based to "a lot of the package inserts, a lot of the procedures for lab."

Participants did not just identify text-based readings as disciplinary, but also

acknowledged the multiple semiotic nature of MLS disciplinary reading (Camillo, 2019)

and saw it to include reading microbiology plates, viewing slides with cells, and even

recognizing sounds from an analyzer. Zoe added all these readings are inherently part of

the "language of the lab." Participant views on MLS disciplinary readings were

inherently tied to both how they viewed the discipline and their individual role they held

in the discipline. Purposeful reading was thus based upon the disciplinary context in

which the reading occurred.

When Mary completed her oral reading, she integrated the images with her oral

reading, "And they're very clearly - I mean they look exactly like the Rhizopus that I saw

in lab." This type of schema-driven construction of disciplinary knowledge, connecting

past experiences in the lab with disciplinary reading was evidenced throughout

participants. Rylee made connections to both her classroom experience and her clinical

rotation:

> When they were describing the PCR technique, I was relating it back to when we
>
> did PCR in class. And then, when I was looking at the bacterial isolates, I was
>
> trying to remember if I had seen any of them in my micro rotation…in my micro
>
> rotation, I learned that everything is changing so quickly, and you really have to
>
> stay on top of it to be able to be a good MLS.

Here, Rylee was making connections between her past experiences from both classroom

laboratory experiences and clinical internships to the article she read. But she also

considered what she will have to do in the future in order to maintain her practice.

Darrin also verbalized this connection between past experiences tied to current laboratory experiences after her oral reading. She considered the case study she had read, "I think they give us ultimately a broader picture of exactly what we're doing on a day-to-day basis…and honestly more meaning to your work." Darrin noted how she internalized the reading and it helped her see the relevance she had to the field. She continued, noting how her connection between reading the article and considering what she was doing to stay current:

> I work in micro, but I feel like maybe I've lost my touch a little bit with plate reading. At least, I haven't done it in like a year…it makes me realize that I do need to keep up with other areas than just what I'm specializing in right now.

While Darrin had selected microbiology as her sub-specialty for the topic to read, she acknowledged how even within microbiology there are additional layers of specialization. When she read her self-selected article, she chose a topic directly related to what she used in her lab and noted, "it's actually a test that we use in our lab…when I read the ACULA portion I was kind of ready for it." This purposeful selection of text enabled her to make direct connections to what she was doing daily as an MLS.

Lailah also directly connected her reading of the text I provided to how it would be useful to her at work, "knowing the general idea of how this would affect – or what this looks like when running lab tests…and knowing how that would affect specimens and lab results." Lailah took a practical approach to connecting her reading to what she was encountering at work. Lailah was no longer in school, to her, relevance would manifest by what is applicable to her daily in the MLS discipline. Violet similarly considered how the reading she completed was relevant to her as a practicing MLS. She

recalled seeing similar situations at work to what was depicted in the case study she read, and felt it to be applicable for her at work. Violet noted at work she was held accountable for the patient results she released and the article could provide justification for the clinical decisions she made on the job.

Connections to the MLS experience were not solely based on past experiences or current practice, but participants frequently noted relevance for the future as well. Violet noted how the one article was not directly related to her current job, but rather to the possibility of future jobs or situations. Norma self-selected a section from her textbook to read on forensic microbiology because it provided a different perspective on what she could do as an MLS, "you don't have to just work in a hospital with this degree, you can work in a crime lab or something." Through her reading, Norma was able to see the opportunity for future work based on her interest in a specialized area of microbiology. Bethany also considered the article she read from a managerial position, "to look forward and say is this an assay that I should have on my radar to potentially bring in my lab …because you don't decide one day to bring an assay and have it the next." While the article was not related to Bethany's current role, she was able to infer how the article could be relevant for another MLS. As faculty professionals, Bethany, Mona, and Zoe regularly considered how they could bring various disciplinary articles they read into the classroom. Whether that was in the form providing the entire text for a student to read or pulling out pieces to include in a lecture.

This first theme demonstrated the awareness each participant developed for the MLS disciplinary reading process. All participants began to appreciate reading as a meaning making process through their engagement in Miscue Analysis, RMA, and

CRMA. Participants identified common reading strategies used, and became aware of their usage of socio-cognitive reading strategies for meaning making. Readers also discussed individual motivation for disciplinary readings and connections between their disciplinary readings and their laboratory experiences.

Becoming Aware of Self as a Reflective MLS Disciplinary Reader

All participants had the opportunity for both reflection and discussion surrounding the various ways in which they were able to make sense of their disciplinary texts through continual collaborative engagement during CRMA sessions. The ensuing theme traces how the CRMA sessions enabled participants to discover how they were creating meaning as disciplinary readers and learners, allowed for an in-depth self-reflection about MLS disciplinary reading, and created opportunities for ownership of their learning as MLS readers.

Learning as a MLS Disciplinary Reader

Each participant met with me individually on multiple occasions. I introduced participants to what Miscue Analysis can reveal in how they were coming to understand their disciplinary texts during their individual RMA sessions. We also discussed key features from their retellings that point towards how they ultimately comprehended their disciplinary texts. I had additional meetings with the college students following their second oral reading of the same disciplinary text. By reading the same text, I was able to look across the participants for similarities and differences in their understanding and meaning-making processes. I begin with a descriptive analysis on their understanding from the text they read and then go into more detail about how these college readers

began to learn about themselves as disciplinary readers through their discussions on miscues during both RMA and CRMA.

Discovering What Retellings Reveal about MLS Disciplinary Readers

I assessed each reader's comprehension of the text they read from the unaided and aided retellings by using the Holistic Evaluation of the Reader Form (Davenport, 2002). See Table 8 for holistic comprehension scores from each college student's reading of the second orally read text, *Markedly Elevated Indirect Bilirubin in an 11-Year-Old African American Boy: Normal or Aberrant?* (Chang, Akl, & Blick, 2013). For this second text, all readers showed similar strengths when reading in relation to meaning construction, see Table 8 (see Chapter 3 for a more detailed description of sentence coding).

Table 8

Reading Miscue Inventory (RMI) Scores from College Students Second Oral Reading

	Max	Norma	Rylee	Mary	Logan
Reading duration (sec)	525	620	1,000	790	600
Total Miscues	34	50	30	49	25
Miscues per 100 words	2.8	4.1	2.5	4.1	2.0
Meaning construction					
• No loss	100%	89%	87%	86%	91 %
• Partial loss	0%	4%	2%	2%	2 %
• Loss	0 %	7%	11 %	12%	7 %
Holistic Retelling Score	75%	85%	85%	85%	70%

Note. From "Markedly Elevated Indirect Bilirubin in an 11-Year-Old African American Boy: Normal or Aberrant?" (Chang et al., 2013).

An overview of readers' comprehending and comprehension scores showed how Max produced 100% of the sentences syntactically and semantically acceptable without any loss in meaning. This is in comparison to his retelling score of 75%. He recalled basic facts from the article and made few connections to practice. He demonstrated a basic level of understanding about the concept presented in the article. He noted in his BRI that he wanted to be able to "read out loud without hiccups." He prioritized accuracy of his oral reading and discussed this attention to the audience frequently throughout this study. The other readers were more consistent in how they transacted with the text. While they had a higher percentage of produced sentences with some degree of meaning loss, they exhibited higher levels of comprehension, as depicted in their holistic retelling scores. Logan's score was lower than the other college students, he was also the only reader who was a junior at the time of the reading. He had less disciplinary knowledge and experience to aide in his comprehension.

The retellings were a critical component of analysis, as they reveal what a reader understood from the disciplinary text they read. As noted above, unaided retellings alone are not fully indicative of what a reader has understood. An important component to look at it in conjunction with the unaided and aided retellings are the miscues each reader made. The miscues provide insight into each readers' strategic reading process and highlight the various socio-cognitive strategies they used when reading their disciplinary texts.

Reflecting on Miscues That Both Contribute To and Hinder Meaning-Making as a

Disciplinary Reader

Each participant was able to participate in multiple CRMA sessions over the

course of three months. Over this period, participants were given the opportunity to

discuss with me, and then other members of their CRMA Teams, the miscues they made.

Discussions initially centered on miscues that contributed to each reader's meaning

making processes as disciplinary readers. Then, as everyone's comfort level with each

other and the process of Miscue Analysis increased, we were also able to discuss miscues

that could hinder meaning making efforts as disciplinary readers. Below are key

highlights into how participants used CRMA to co-construct disciplinary literacy

knowledge.

During the third CRMA session, Team B had the chance to discuss Violet's

miscues from her oral reading of *Variable Potassium Concentrations: Which Is Right and*

Which Is Wrong? (Theparee et al., 2017). Violet and I first discussed the reading during

her RMA. We highlighted the sentence below (see Figure 6) during this RMA session

and then we decided to also use it for discussion during the CRMA session. Violet

showed areas where she used her disciplinary knowledge to make meaning, but in the

same sentence provided an example of how a miscue can hinder the meaning making

process.

Figure 6

Violet's Uncorrected Miscues, Substitution Miscues, Insertions, & Omission Miscues

Note. From "Variable Potassium Concentrations: Which Is Right and Which Is Wrong?" (Theparee et al., 2017, p. 183).

Violet acknowledged how she substituted *creatine* for *creatinine* during her initial RMA session with me. Creatine is a chemical produced from muscle breakdown which the body further breaks down to creatinine. She reflected how the two words had a high graphic similarity. Both words start the same, with creatine being a shorter word (eight letters) compared to creatinine (ten letters). We discussed how she saw the word, made a prediction for the word based upon the first few letters of the word, and then kept reading. She recognized they were different structures but also mentioned how she and

her peers at work would often say them interchangeably. The word *creatinine* appeared

four times in the text. On the first and third time Violet read the word, she said *creatine*

but did not correct herself. When she read the word the second and fourth times, she

initially said *creatine* then immediately self-corrected to *creatinine*. Her oral reading

demonstrated how she indeed approached the two words as interchangeable. She reported

they are separate concepts and for the case study she read it was important to differentiate

the two words. She noted that she should have corrected the word each time she miscued

during her oral reading.

Violet jumped in during Team B's discussion, highlighting how she should have

corrected herself and that her miscue changed the meaning of the sentence (see Figure 6).

The group went on to discuss how her disciplinary knowledge contributed to her meaning

making processes for other miscues she made in the same sentence:

> Violet: One that still cracks me up – the creatine versus creatinine. Twice that it
>
> says creatinine and I sometimes say creatine. And I guess, because they
>
> are technically two different things, and I should have actually said the
>
> right one. I should have corrected myself. But I guess they're so similar
>
> and honestly, they're on two sides of the same chemical reaction, so we
>
> use them kind of interchangeably when we are speaking fast at work. So,
>
> that's why I've flagged my importance on enunciating which one it is, but
>
> that one cracks me up.
>
> Logan: In looking through the reading for this one, I think a lot of the miscues

were more so reading as quickly as possible and not really thinking about

what you're saying, but still understanding the text as you're reading it

mentally, you know.

Violet: I thought, yeah – it sounded like I was reading it more for myself, to get a

case study down in my head, and less for an audience that might be

interested in hearing what I had to say. I just read it like I was trying to

read a case study and figure out a picture, instead of educating somebody.

I skipped a bunch of reference ranges, because I didn't need to repeat any.

Zoe: Violet, did you notice that you also added "s" to the ends of several of the

words? Like, you said *white blood cells*.

Violet: I probably did notice; my list is pretty large of all my mistakes. I don't

know why…yeah, I say white blood cells more than I say WBC.

Zoe: Well, and you also - because for that one you said *white blood cells* and a

number, you left out the *count*. Which – that didn't change the meaning of

the sentence, and it was understandable, and I feel like that made sense for

what you would probably say in real life in this case.

Violet: Right! Like on the phone or to my coworkers or something. I would say

white blood cells, because they know it's a count if I'm ever going to tell

you about it. Oh! And I noticed this one, and we'll probably notice it in

all the other readings, too, because we're in the same field, and we know

the same units, and how to say the units. We don't say *m-g per d-L* we say

milligrams per deciliter. That's something that Meghan had brought up

when we were reviewing mine personally. … I guess I did not think that

that was a miscue! Because that's – when I see *m-g* I see *milligrams*, I

don't even see *m-g*. But I've noticed that everyone's readings, they all did

that.

During this exchange the group addressed how Violet's substitution of *creatine* for

creatinine changed the meaning of the sentence. I coded this sentence as YN- on Violet's

marked typescript. She produced a sentence that was syntactically acceptable, but was not

semantically acceptable and thus had a meaning change. The group went on to

acknowledge how some miscues interrupted the flow of a reading and impeded

understanding. She saw the start of the word and given the two words had a high degree

of similarity, she did not make her prediction effectively. But solely saying the word

correctly does not translate to understanding what it means. Violet stated she understood

what creatinine was and how it worked in the body. She also understood how the levels

of creatinine would change if there was disease present. Despite her going back and forth

in what she said, she understood what was happening in the patient described in the

article she read.

        In this exchange, the group also identified how Violet's miscues revealed how she

was making meaning while reading. Her disciplinary knowledge came into focus as she

used conventions of the discipline to report out the units for various lab values presented.

She made a conscious choice to omit the reference ranges during her reading. But she

noted how she was skimming the ranges even though she didn't read them out loud. She

felt it impeded the flow of the reading to read out all the reference ranges, that would

inherently be understood by fellow MLS's. She added an "*s*" to the term *white blood cell*,

and by making it plural, she referred to the count as she would typically do when talking

to another person in the field. These miscues helped Violet to make sense of the text as she was reading. She integrated her prior knowledge and her expectations for how lab values are reported in the discipline to aide her in transacting with the text. During her retelling she was able to recall the high white blood cell count and connect it to the case study she read, but she also considered how she could use the information she learned from the case study to help her at work.

In the excerpt from the Team's CRMA session above, Violet stated she made a lot of "mistakes." In the same exchange she also referenced her miscues. Violet had never heard of the term miscue at the start of the study. When we first sat down to complete her RMA session, she repeatedly referred to her miscues as mistakes. I encouraged her to consider those points where her oral reading differed from the printed text as miscues not mistakes. With each subsequent CRMA session we completed, she increasingly transitioned to calling them miscues. By the fifth and final CRMA session she was no longer referring to her miscues as mistakes. This growth in how she approached her oral reading was not instantaneous and required Violet to reconsider how she approached her disciplinary readings. She reflected that she had considered them "mistakes" based upon her interpretation of the text holding the correct meaning and she did not want to be seen as producing something incorrectly. She began to appreciate how she was actively transacting with the text she read and how her miscues were often purposefully driven and held meaning.

Even though Violet's orally read sentence, coded as YN-, indicated a reading weakness, much of her work in the sentence highlighted her strengths as a disciplinary reader. She was able to successfully integrate her prior knowledge on the topic to help

with her understanding as she was reading. The group was able to appreciate that not all

miscues need to be corrected. They were able to discuss the purpose of reading being for

comprehension and how many of the miscues produced by Violet enhanced her

understanding as she read the text. However, the group did not shy away from also

considering those miscues that hindered her meaning making while reading.

Perceptions about MLS Disciplinary Reading

Each participant was able to consider their perceptions about disciplinary reading.

Key insights into how participant's reflections on disciplinary reading developed during

CRMA sessions, how they came to view disciplinary discourse as reflective of MLS

cultural norms, and their reflections on reading out loud as adult learners became

apparent. Participants came to an understanding of their perceptions on reading as

contributory to disciplinary literacy knowledge. To better situate each reader, I include a

discussion of initial perceptions on both reading and disciplinary reading gathered during

Individual Burke Reading Interviews (Y. Goodman et al., 2005). These interviews

allowed readers to reflect on their past experiences with reading as contributory to their

current approach to MLS disciplinary texts and add to the depth of information revealed

in better understanding their current transactions with disciplinary texts. Following each

CRMA session, I provided exit reflection questions to all participants. Participants

reflected on how their perceptions about reading evolved based upon comments made

during initial Burke Reading Interview sessions (Y. Goodman et al., 2005), CRMA

sessions, responses to exit reflection questions following each CRMA session, and post-

study Burke Reading Interview sessions (Y. Goodman et al., 2005). Through

participation in multiple CRMA sessions, readers' awareness about the MLS disciplinary reading process evolved.

The MLS college students in this study, Logan, Mary, Norma, Max, and Rylee, tied motivation in reading to success. They acknowledged disciplinary texts as their most challenging reading during their BRI sessions with me. They went on to discuss their personal challenges they had with the disciplinary texts read during this study amongst each other during the CRMA sessions. They were able to appreciate different perspectives on disciplinary texts they had not previously considered through their participation in the CRMA sessions and discussions of their readings with others. Their confidence in their disciplinary literacy knowledge increased as they interacted with their peers and came to realize they all had similar approaches to and understanding of their disciplinary readings. Ascending professionals, Lailah, Darrin, and Violet, likewise found disciplinary texts to be difficult, due to their frequent usage of jargon and grammatical structure. Despite these challenges, they felt disciplinary texts to be important to understand and use and appreciated how their own understanding of disciplinary texts changed through their CRMA reflections. Faculty professionals, Bethany, Mona, and Zoe, readily identified vocabulary as the likely culprit that would still cause them trouble in their own disciplinary readings, acknowledging they still had to put effort into understanding disciplinary texts. They also reflected on how they helped students understand disciplinary texts.

College Students' Perceptions about Disciplinary Reading

The college students all recognized one of their greatest challenges with their disciplinary readings was finding the time to complete them. They noted it could be

difficult to balance their time with their disciplinary courses. Aside from the time needed

to invest in understanding their disciplinary readings, Norma also cited a personal

challenge for her was tied to motivation to read. She reflected how she would sit and read

for long, infrequent stretches of time. Through her participation, Norma concluded she

needed to take her time with her reading, "I have always been the type of person who

reads just to say I have finished something and make myself feel accomplished. But I find

whenever I do that, I can't retain what I just read easily." She added how she would like

to work on not skimming texts just to get through them, but would rather immerse herself

in the reading and learn from it. Rylee similarly felt her lack of motivation to read a

disciplinary text made it hard for her to stay focused. Mary also noted this lack of focus

and she often would feel overwhelmed by some of her disciplinary texts, even before she

started reading them.

        Another common challenge noted by each of the college students was

understanding their disciplinary vocabulary. As the study progressed, Max noted

inadequacies in his reading he wanted to work on, "I believe I need more exposure to less

common medical terminology." His interactions with the group during CRMA sessions

revealed to him areas of his own reading strengths and areas of weakness for him to

improve. This insight enabled him to set goals for his future disciplinary readings.

        Logan, Rylee, and Norma each indicated they hoped to gain insights in how

others both read and learn from their disciplinary texts. Both Norma and Mary

appreciated other readers' perspectives when reading disciplinary texts and tried to

understand why they made certain miscues. Mary compared learning about the reading

process as an adult to trying to master a new sport, and acknowledged it could be

overwhelming. She discussed learning to read growing up, but as an adult, "we don't really think about ways to read and how much goes into that, and how the way you read translates into how much you remember, and how well you can apply it in other areas." Mary began to appreciate how Miscue Analysis revealed how much each of the readers in the study did indeed know, and how they used their strengths as readers to understand their disciplinary texts. Logan wanted to gain insight into his own reading habits and find ways to improve his reading and comprehension skills with CRMA. He acknowledged his comfort with making high quality miscues and did not feel they hindered his reading comprehension. By the fourth CRMA session Logan noted an emerging awareness into his own reading process, "I find it very interesting to see how I frequently change the grammar or language in the journals to better fit my preferences as a reader." He felt while not typically done, it was helpful to talk about reading in MLS to see different perspectives. Here he referenced Mona's desire for more patient background on the case study they discussed in one of their CRMA sessions. CRMA allowed Logan to consider the reading process from a disciplinary standpoint. By the end, Logan admitted he had a strong interest in language and linguistics and further reflected:

> I think the verbal miscues reflect more on how we use language, our preferences
> for grammar and structure, and more English or comprehension related things
> rather than our comprehension of MLS disciplines…the dialects that we would
> have grown up with or have adjusted to, as well as maybe reflecting education.
> Someone who is formally educated versus someone who may have taught
> themselves about this field may reflect miscues as well. I don't know how
> possible this would be, but I do think it would be interesting to see how people

who just have an interest in the field and are not going to school for it may

comprehend the text and miscue.

Logan considered the reading process holistically. Logan began to show an awareness for

his own disciplinary knowledge as contributory to understanding disciplinary texts when

he reflected above on how miscues would be different in someone formerly educated in

the field versus someone who was interested in the discipline but had no training. While

he initially was unsure how Miscue Analysis played into disciplinary comprehension, by

the end of the fifth CRMA session he acknowledged how a greater understanding in the

discipline played into comprehension of disciplinary texts.

All the college students noted an increase in their confidence of their disciplinary

reading. Mary noted seeing how other readers miscued gave her confidence in her own

reading and she felt more in line with her peers. Rylee noted CRMA gave her confidence

in her disciplinary reading, "seeing how we all make miscues, even experts" made her

feel more secure and on the same level as her peers. Through her participation, Mary felt

her "quirks" as a person translated to her reading, "I am very stubborn and willful, which

was conveyed when I persistently articulated phrases that I stumbled on multiple times."

Mary valued discovering about herself as reader through CRMA and building confidence

in herself as a disciplinary reader.

Ascending Professionals' Disciplinary Reading Perceptions

The ascending professionals, Lailah, Darrin, and Violet, noted their perceptions

about themselves as readers and disciplinary readers at the start of the study, and spoke

about things they would like to change in their disciplinary reading during their BRI

sessions (Y. Goodman et al., 2005). Lailah felt she was a "casual" reader and wished she

could read faster, especially in her disciplinary readings. Darrin considered herself "just

below average" and recalled struggling with reading as a child and felt this persisted in

her disciplinary readings. Violet was confident in how she approached disciplinary

reading and felt if she could change anything it would be to devote more time to her

disciplinary readings. All three cited challenges with their disciplinary texts to be

primarily related to vocabulary and content. Lailah specifically noted she would like to

improve her disciplinary vocabulary to help understand her disciplinary texts better.

Darrin touched on difficulties with disciplinary reading related to comprehension as well

and noted the articles she read for work on gene sequencing were challenging due to their

in-depth nature. Violet saw difficulties in disciplinary reading primarily as

comprehension based.

  Violet recognized the social nature of reading. She noted if someone's difficulty

during reading stemmed from boredom, she would sit and read with them. She

commented throughout the study how she enjoyed interacting with others and

participating. Initially, she viewed a good reader as someone who would read out loud

without difficulty and noted "I'm only determining their reading ability because of what

they say out loud, because that's the only way I know they're good at it." Violet focused

on the performance aspect of the reading as being indicative of a good reader, but did not

mention understanding in relation to reading. This contrasted with her views on

difficulties with reading being tied to comprehension.

  All three felt their perspectives on disciplinary reading shift as they participated in

CRMA sessions for this study. As Lailah and Darrin participated in each CRMA session

their confidence in their disciplinary reading grew. Toward the end of the study Darrin

reflected, "I feel now very average with my own reading and now understand that fast

reading does not always equal efficient reading." She found each CRMA session to be

personally relevant and meaningful in helping her develop confidence in her own abilities

and disciplinary reading. Violet on the other hand felt more humbled in how she

approached her disciplinary reading. Through her participation in CRMA she was able to

see more diverse perspectives on how to approach and understand disciplinary readings.

She noted, "I've learned to doubt myself and my interpretation in a good way. In a way

that makes me more humble and willing to reread and reinterpret things." Violet's initial

views on what makes someone a good reader were clearly challenged, and she became

more aware of the intricacies related to the reading process. Lailah's thoughts on speed in

relation to her disciplinary readings changed, "as a student and working professional, I

think now my reading practices are geared more towards having better comprehension

rather than speed, since these types of readings are more useful for gaining understanding

on a topic." She began to value comprehension over speed and was more aware of the

impact her understanding had on a disciplinary text. Darrin similarly reflected on her

understanding that fast reading does not always equal efficient reading.

Faculty Professionals' Reflections on Disciplinary Reading

Bethany, Mona, and Zoe considered what would cause them trouble with their

disciplinary readings as faculty professionals. All three noted it would likely be

vocabulary that could impede their understanding. The three of them noted a focus for

participating in CRMA sessions for this study was what they themselves could learn and

how that could better equip them in their approach to helping students with disciplinary

readings. All three recognized they first needed to identify what problems the student had

with their readings. Bethany differentiated finding out if it was a long-standing problem with reading in general or new. As a new problem, she further differentiated the difficulty as someone new to the MLS program and "now they're encountering just a lot of vocabulary or phrases or ways of saying things that are part of our discipline and that's what's tripping them up." She recognized her own difficulties with disciplinary vocabulary as an expert and was sensitive to this difficulty in a novice. Mona similarly considered if the students' difficulties stemmed from vocabulary, understanding concepts, or following a procedure. She noted she would walk a student through a procedure to identify "at what point is it that we lose you, that you don't get it." She was conscientious of trying to meet a student at their own level of understanding when helping them.

Bethany, along with Mona and Zoe, consistently monitored what she could learn from each CRMA session to help in her interactions with students. They acknowledged the degree their own background knowledge played into understanding disciplinary texts and noted for students it may not be enough to simply tell them to read something and expect much from them. Students may skip over terms they don't understand and miss the meaning of a text. Bethany felt she developed more of a conscious awareness in how she transacted with her texts and felt this awareness would be helpful in her approach to students through CRMA. She noted, "how quickly I can comprehend and analyze in comparison to a novice." She was becoming aware of how tacit her disciplinary reading process was and started to consider how she could make this explicit to students. This explicit awareness for Bethany was pivotal in her thinking about students reading their disciplinary texts, "how much harder it is for them than I really appreciated."

Mona and Zoe were both openly sensitive to how students might feel having a CRMA session with their professors. Zoe noted she was self-conscious of her own oral reading. She reflected that it was hard listening to her own miscues in front of the students, "I know that it is part of this process but sometimes I think we – faculty – are seen as infallible and that is a hard image to live up to, and perhaps we shouldn't try!" Zoe acknowledged the hierarchy of having MLS's of different levels of experience discussing their oral readings. As the CRMA focus turned toward discussing student miscues she, "liked that it wasn't me getting evaluated!" For Zoe, it was just as intimidating having her oral reading analyzed by students as it was for students to have their professors listening to their oral readings. Similarly, Mona noted how she didn't like hearing her own voice. She appreciated how intimidating it could be for students to discuss their readings in front of a teacher and loved the participation, "it was wonderful seeing Mary and Norma adding their observations and not feeling intimidated!" This insight into how it felt to read out loud made Mona more encouraging to other participants in discussions of their readings.

Awareness of Disciplinary Discourse through CRMA as Evidence of MLS Cultural Norms and Practices

Participants connected their disciplinary readings used in this study to their daily lives and exemplified how discussions about their readings were rooted in the MLS culture. To discuss their disciplinary readings, each participant came in with some level of disciplinary background knowledge, understood disciplinary vocabulary, and was able to appreciate the "disciplinary jargon" used. Many of the miscues discussed during each of the CRMA sessions from both Team A and B highlighted how participants

acknowledged certain ways of speaking inherent to the lab and demonstrated how this fostered a sense of belonging to the MLS culture.

Following Team B's third CRMA session, Zoe noted, "It is interesting to listen to the students and understand our nuanced 'language of the lab' - and I really think it is interesting that current students are tuned in to that language." Zoe was aware that individuals working in a lab would feel connected to the culture of the lab and exhibit the ways of speaking inherent to the that culture. When Zoe stated "language of the lab," she understood the MLS profession to have a discrete disciplinary literacy and the ways in which member communicated was inherently disciplinary specific. She was surprised how students were already exhibiting this sense of belonging through their usage of language. She further considered how that sense of belonging developed the longer they were in the MLS program and wondered how first-semester juniors would feel and speak compared to second-semester junior students. As a student, Logan reflected how someone not "super familiar with the lingo and testing involved," would likely not understand a disciplinary text. This understanding of the "language of the lab" was brought up repeatedly through each CRMA session.

Both Zoe and Logan read out loud a transfusion medicine disciplinary text, *Acute Hemolytic Transfusion Reaction Due to Pooled Platelets: A Rare but Serious Adverse Event* (Grammon et al., 2020). There were many abbreviations used in the text that were specific to the MLS discipline and transfusion medicine specifically. An excerpt from Zoe's oral reading of this text is below (see Figure 7). The discussion by her Team exemplified how they were considering their language of the lab.

Figure 7

Zoe's Repeated Substitution, Uncorrected, Abandoning a Correct Form, Corrected, and

Repetition Miscues, with Self Talk

Note. From "Acute Hemolytic Transfusion Reaction Due to Pooled Platelets: A Rare but

Serious Adverse Event" (Gammon et al., 2020, p. 3).

The text from Figure 7 above read by Zoe as she finally produced it, included her self-

talk:

> In pooled platelet associated acute hemolytic transfusion reactions, anti-A titers
>
> ranged from 32 to 16,000 with a mean – to a mean titer "wow that's big" of
>
> 512…One study screened 120 – 124 group O pooled platelets "um, hang on, let
>
> me look. I'm pretty sure its pooled platelets, yeah, pooled platelet concentrate,"
>
> screened 124 group O pooled platelets for anti-A and anti-B by both standard tube
>
> and manual gel tests.

During the ensuing discussion of Zoe's oral reading from Team B's second CRMA

session, Norma noted her own understanding of the abbreviation PLT for platelet, but

added the additional P was an area of confusion for her. She appreciated, as someone

listening to the oral reading, how Zoe clarified her reading. The group went on to discuss

how abbreviations are typically used in clinical laboratories, both transfusion medicine

labs and microbiology labs:

> Norma: I noticed that towards the end, so the abbreviation *PPLT* is used
>
> repeatedly throughout the text, but then towards the end, she went
>
> back…to see what the abbreviation meant, and I actually appreciated that
>
> because the whole time I was like, I know it's platelets but, like, why is
>
> there a P in front of it.

> Zoe: Yes, I definitely was in the middle of it, going, wait a minute, am I saying
>
> that right…I know that I spelled out – or I stated out what A-H, A-H-T –
>
> see, I can't even say it right! What A-H-T-Rs are. Instead of just saying A-
>
> H-T-Rs, because I feel like that means nothing to me, but acute hemolytic
>
> transfusion reaction certainly means something to me.

> Mona: Is that an abbreviation that's commonly used in the transfusion services
>
> world or not?

> Zoe: I suppose- I mean, I think in the textbooks and stuff, yes, and maybe they
>
> would have it in the [computer] system. But usually, we say acute
>
> hemolytic transfusion reaction or acute transfusion reaction, something
>
> like that. I mean when we're talking, we're not going, it was an A-H-T-R!

> Mona: We do – in micro, we say M-R-S-A all the time. We don't spell it out – or

we don't say it every time. We never say methicillin resistant *Staph*

aureus! We always say M-R-S-A!

In this conversation it became clear how these readers were connecting their disciplinary

knowledge with conventions of speaking in the discipline. They were immediately

making the substitution when reading their disciplinary texts out loud to fit how they

would typically hear and speak these terminologies in the lab. This exchange

demonstrated their usage of socio-cognitive strategies for meaning making based upon

Zoe's reading. While this section of text analysis occurred using one of the expert

professionals' oral readings, this type of miscue occurred throughout each participant's

reading.

During Team A's fourth CRMA session, Max led a discussion on his miscues

surrounding the second orally read chemistry text, *Markedly Elevated Indirect Bilirubin*

in an 11-Year-Old African American Boy: Normal or Aberrant? (Chang et al., 2013). The

text referenced multiple chemistry tests throughout, initially, the full test name was listed

which was then followed with the abbreviation. The following is how Max navigated the

text and terminologies (see Figure 8).

Figure 8

Max's Omissions, Insertions, and Self-Correction Miscues

Note. From "Markedly Elevated Indirect Bilirubin in an 11-Year-Old African American Boy: Normal or Aberrant?" (Chang, et al., 2013, p. 262).

Max was clearly selective of when he would use abbreviations versus saying out a whole word. He was also selective in how he shortened *alkaline phosphatase* to just "*alk phos*." These were discussed in Team A's fourth CRMA session:

> Max: I started off with reading out *gamma glutamine transferase*, but I believe, when I was halfway through, I realized what it was, and just referred to it as *GGT*. I think that was interesting because it shows I actually know what it is and what I'm familiar to hearing. How I was

taught it by Bethany. Because we barely ever say the whole word in real

life settings. I think that was interesting as far as changing the meaning, I

don't believe it did.

Bethany: You just didn't do *GGT* -

Max: *Alkaline Phosphatase*!

Bethany: Yeah! And I loved it - I loved it…It showed me that you were utterly

comfortable with what those things meant.

Max: Right.

Bethany: You didn't even breathe, you just said *Alk Phos* and went on. Which said

to me, you know what that means and you wasted no other brain cell on it,

because you instantly [knew] - and that's a good thing.

Max: Right, right! And similar to GGT, nobody ever actually says Alkaline

phosphatase. In real life we all refer to it as Alk Phos, that's how I learned

it and that's what I was comfortable with, and I think it does show my

level of knowledge in the discipline.

Bethany: I'm not a reading specialist, but it seems to me, you actually did read it.

I mean you had to read the words *alkaline phosphatase* and translate that

to *Alk Phos*. You made that instantaneous translation, which is – Great!

It's not like you didn't read the words, you did! You just processed them,

like that.

Lailah: Oh yeah! No one's spending time going through the whole word! At that

point, I feel like the person you're talking to probably left you by the time

you finish saying the whole word. Abbreviations are what we commonly

use, because we're all familiar with what they mean.

Team A's discussion above showed how across all three groups, there was a familiarity

with the language conventions used in the lab. The way Max read the text, even though

he was a student, showed he was "in tune to the language of the lab" as Zoe had noted.

This tacit way of expressing disciplinary terms was made explicit by the group and

showed how this was a way for members of this MLS community to feel connected to the

MLS culture. With Bethany's scaffolding and encouragement, Max further considered

how his usage of terminology demonstrated his development in the discipline. Max

gained confidence in his usage of socio-cognitive reading strategies he made during his

disciplinary reading to help increase his understanding of the text he read.

Each of the college students read the same chemistry text for their second oral

reading with me. Across all students, they were repeatedly using these same

abbreviations and then reflecting on them during their CRMA discussions. During Team

B's fourth CRMA session, Logan's oral reading of the same chemistry text (Chang et al.,

2013) was discussed (see Figure 9).

Figure 9

Logan's Insertions, Omissions, and Self-Correction Miscues

Note. From "Markedly Elevated Indirect Bilirubin in an 11-Year-Old African American Boy: Normal or Aberrant?" (Chang, et al., 2013, p. 262).

Like Max, Logan made selective omissions using his disciplinary knowledge. These omissions revealed the college students' common and effective strategic approach to the disciplinary text they read. Logan was harnessing all three language systems as he made sense of the text. Logan went on to lead the discussion of his miscues during his oral reading:

Logan: I omitted saying the full names for AST and ALT and then I also change

the case. So, I inserted and I said *a mildly elevated.* Then later in the

sentence, I also changed the verb to a singular and I said *indicate* instead

of *indicates*.

Norma: I think it's one of those things that kind of comes with experience. Like, if

your audience is a bunch of MLSs, then chances are they'll understand

what you're saying when you say AST and ALT. And plus, those are kind

of long, complicated messes – the chemical names. Sometimes you just

don't want to take the time to say that. And if everyone understands what

you're saying, why not just use the abbreviation.

Violet: It shows she understands her audience is another MLS and that it

shouldn't be an introduction to these words.

Mona: I know AST and ALT better than I know the full names! You say AST,

ALT, I know what you mean. If you had said elevated aspartame

transaminase, I might remember what that all means! So, I think

particularly skipping over, for those abbreviations, made perfect sense.

Darrin: I think a lot of people in our profession will recognize AST and ALT

more often than the full names. I agree with Mona!

Mary: And I think the abbreviations themselves, we've learned to correlate them

with liver problems. So that just helps you kind of make sense of it.

The conversation during the fourth CRMA session of Logan's miscues not only

considered the commonplace way of using abbreviations, but additionally highlighted an

awareness of audience while reading. Mary also connected the abbreviations of the

chemistry tests used back to the focus of the article, the case study, and their relevance to

the liver. She recognized that when an MLS is discussing liver disease there are certain

tests that would correspond to the liver and having the article mention them supported her

understanding. These tests fit into her expected schema for liver disease.

Experiences and Reflections on Reading Out Loud

Each reader was self-conscious about reading out loud in front of other people,

especially me, during this study. I saw this during each reader's oral reading, they also

mentioned this directly to me during their BRI sessions and individual RMA sessions, as

well as discussed with each other during their CRMA sessions. Prior to beginning their

reading, I instructed each reader to read the text as they normally would. I told them I

would ask them about their understanding of the text when they finished. Despite this

instruction to read for themselves, they became consciously aware of my presence during

their reading.

Readers discussed this awareness as they reflected on their choices while reading

and subsequent miscues. Max readily acknowledged this performance aspect, "I feel like

personally, with all the miscues I've made, were me trying to reword the structure of

whatever I was reading to try to make the audience understand what I was actually

saying." Even at the end of the study he was still prioritizing his audience when reading

out loud. As the study progressed, some participants noted this awareness, but

consciously worked on turning their focus to understanding not performing. Mary noted,

"even while reading pieces out loud, I think at times I was more focused on my audience

and potential miscues than the actual content of the piece." But Mary acknowledged this

audience awareness and noted she purposefully worked to read her second orally read

text with a focus on her own understanding rather than on performing.

Max and Rylee discussed their different approaches to their second orally read

text during Team A's fourth CRMA session. Here the discussion was how Rylee made

choices in her reading that were different from Max's in one specific sentence from

Markedly Elevated Indirect Bilirubin in an 11-Year-Old African American Boy: Normal

or Aberrant? (Chang et al., 2013). The text named a procedure that was unfamiliar to all

five of the student readers. Both Rylee and Max paused prior to attempting to say the

procedure, but Rylee paused immediately prior to the word, while Max paused at the start

of the sentence. Both transacted with the text slightly differently and had different

omission miscues as shown below (see Figures 10 and 11).

Figure 10

Rylee's Articulation Related and Omission Miscues
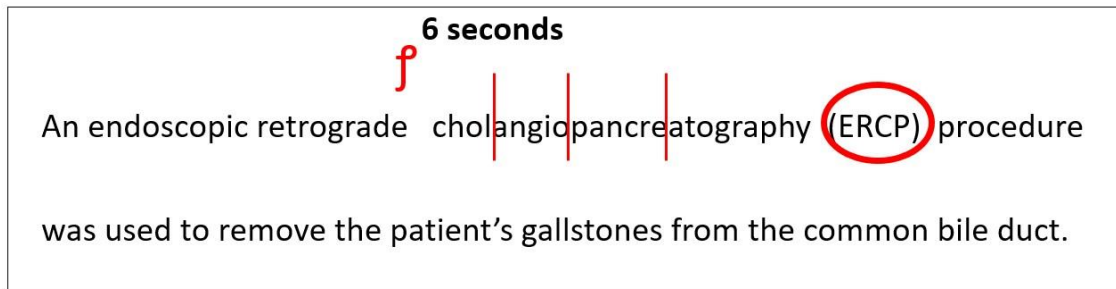
Note. From "Markedly Elevated Indirect Bilirubin in an 11-Year-Old African American

Boy: Normal or Aberrant?" (Chang, et al., 2013, p. 263).

Figure 11

Max's Omission Miscue
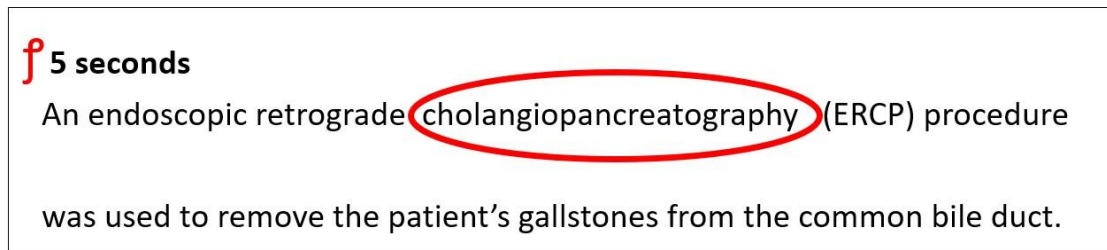
Note. From "Markedly Elevated Indirect Bilirubin in an 11-Year-Old African American Boy: Normal or Aberrant?" (Chang, et al., 2013, p. 263).

Team A discussed the different ways these two students transacted with the text in more detail during their fourth CRMA session:

Rylee: When I was reading it out loud, I guess it made more sense in this situation for me to try and sound it out. Because I wanted to understand the procedure more at this point in the reading then I did just looking at the abbreviations. And I think we said that I paused for six whole seconds before cholangiopancreatography – or however you say that!

Bethany: Well, I noted that you actually skipped saying ERCP at that point. You had navigated the whole thing and then skipped actually saying the ERCP because you were done with it.

Max: And I feel as if she wanted to say the word out loud, for her to improve her understanding about it versus when I was saying it. I was more worried about what the audience would think about it. So, I simply referred to it as ERCP as opposed to trying to understand the word, more

because I recognize it isn't something that's in our field, I realized that it was something that was more radiology related.

Rylee: And that's a big thing that I've noticed in listening to Max lead his session versus how I've led mine. Is that when Max reads, he worries much more about the audience, whereas when I'm reading I worry a lot about my own understanding. Which isn't a bad thing, it's just very interesting to see how that affects how we read differently.

Lailah: And I was gonna say, I think that's why you can see the difference in reading the words in the abbreviated form rather than reading them fully. Because someone that's speaking to people, they want to convey an understanding to people, versus if they're just speaking to themselves, they don't have to put in as much work to convey meaning.

The conversation above demonstrated how the entire group considered the effect of becoming consciously aware of other people around them while reading out loud. It was notably difficult for all these readers to read the disciplinary texts out loud. They all were cognizant of my presence during their reading. Despite this, Rylee commented to me that as she read both texts out loud, she purposefully focused on her own understanding of each text. With each table or figure in the text, she took her time to read the table out loud. Her navigation of the multimodal tables and figures was clear for a listener while she was reading. She reflected on this during the fourth CRMA session when she noted how she worked hard to understand the text and tables. Team A's discussion continued and Max further reflected on the difference in how he and Rylee approached their oral readings:

I think it's interesting that Rylee actually read this and I completely omitted it. There's that too. Her wanting to get all this for herself versus me worried more about the audience. Because, I mean, when you talk out loud, you can't really explain a figure out to an audience.

Max was fully aware of the priority he was placing on ensuring a listener would follow his reading and understand what he was reading, sometimes at the expense of his own understanding of the text read.

Each reader was consciously aware of other people around them while reading aloud, even the faculty professionals. Zoe commented, "I definitely lose meaning or comprehension about what I'm reading or when I feel like I'm 'performing' versus reading for comprehension. I think how I read changes, depending on the purpose of the reading." The idea of purpose as relating to audience awareness was noted in the Team A's discussion during the second CRMA session:

Bethany: But it varies a little with purpose…I think that. You guys didn't need the blanks filled in that heparin induced thrombocytopenia is usually referred to as HIT. Those comments say to me that you're already up at a level where that's superfluous for you. But if you were reading it to an audience, that this is new, you would probably need to say, we call this, you know, we never say disseminated intravascular coagulation, we say DIC. So, it also depends to me on the purpose of why you're reading and who you're reading it to if you're doing it out loud.

Violet: I agree. When you're reading to Meghan you don't you don't tell her that disseminated intravascular coagulation is –

Bethany: Right! Exactly!

Violet: But if I was reading to my fiancée, I'd be like we actually just call that

DIC! But yeah, the crowd was different.

Here, Bethany and Violet acknowledged how the oral reading changed simply because they were reading in front of me, someone with experience in the MLS discipline. Their purpose while reading was tied to who they saw as the intended audience and how they read out loud would subsequently change. This conscious awareness of reading aloud in front of others also highlighted their understanding of the nuances of the discourse of the lab. The language of the lab was brought into focus as well as they reflected on the purpose for the reading and who their audience was.

Creating Opportunities for Learning as an MLS Reader

All participants were able to identify areas where they could take ownership of learning as MLS readers through their reflections on the reading process in the discipline. Faculty professionals were able to consider learning from a student's perspective in a new light and reconsider where there might be difficulties. Bethany noted, "I think it gives me some sensitivity to some speed bumps in the road." She had previously never considered students coming to college without an understanding of roman numerals. A significant part of understanding the science behind how a clot will form involves understanding roman numerals. The pathway to form a clot is named using them. By seeing how Max and Lailah transacted with the hematology text they read and the ensuing CRMA discussion, she realized she was making assumptions about their level of background knowledge. Bethany came to appreciate what the miscues could reveal about how students were thinking and how she could use that for student learning.

Mona further considered how she could provide opportunities for students in the classroom. She considered how students were verbalizing disciplinary terms:

I guess the importance of them hearing these words and having an opportunity to say the words. I guess I had not provided a lot of opportunity, even though I do try to do a lot of quizzing in class. I guess it's usually the same people, giving the answers and not as much of an opportunity across the class to say some of those words.

Here Mona recognized that her own practices in the classroom may not be fostering student growth as she had intended. Through her having the opportunity to hear students reading, and identifying areas where they were struggling, she identified areas for improvement. Mona was able to identify changes she could make to provide students with practice verbalizing specific disciplinary terms.

As ascending professionals, Violet and Darrin considered the opportunities for learning in a few ways. In one sense they reflected on how instruction on reading would be helpful as a student. Violet believed that educators should have enough knowledge about not only the disciplinary topic but also the reading process to make explicit to students the areas in a text where understanding might falter. She was quick to note, though, she did not feel students should be graded on how many miscues they made, as she felt it was an opportunity for learning not critiquing. She also noted, "certain miscues could affect their understanding of concepts which ultimately could affect their grades." But she was adamant that the grade itself should not be based on the number or quality of miscues. At the same time, ascending professionals considered how they could integrate Miscue Analysis into their daily lives as MLS practitioners. Darrin commented in the

fifth CRMA session of just ascending professionals, that at that time she was renewing

her MLS certification and had to complete journal readings for continuing education

credit. She reflected how she read three or four articles on her own. She stated that she

chose to read them out loud to herself to help her understand them better. She was taking

skills she was learning of Miscue Analysis and applied them in her daily life to help her

analyze and understand the disciplinary texts she was reading.

Each of the college students found many ways their participation in Miscue

Analysis afforded them the chance to take ownership of their MLS learning. They were

able to connect what they were doing and learning through this study and identify how it

could benefit them as a student. Rylee had previously participated in Miscue Analysis

research with me and commented:

> I feel that my own reading process is always growing and evolving. Even from
>
> the first round of research, I see a change in how I have been reading and taking
>
> in information. Especially when it comes to reading aloud, I have realized that
>
> while I may be self-conscious of how I sound what really matters is how well the
>
> information can be processed.

Rylee's comments demonstrated her own personal growth in how she was considering

the role reading played. She was able to see the benefits of making an awareness on

reading for comprehension explicit. She highlighted how comprehension of what she read

could help her with her disciplinary literacy knowledge.

Max reflected that he developed a greater appreciation for how a reader's

background impacted their understanding. He noted how Miscue Analysis looks "at the

reader as a whole. …Everything read out loud we read it a certain way for a

reason…being in other countries with non-English speakers, if they read the same passage, they wouldn't read them the same way." Max recognized how his own experiences contributed to how he approached his reading, his learning, and his comprehension. He was aware of this and was considering his reading holistically and had a greater appreciation for how this could help him in his disciplinary learning. Norma agreed that she was understanding her own reading better and how she could harness this new understanding to help with her understanding of disciplinary material. Through Miscue Analysis these college students were becoming aware of how they had influence over their own disciplinary literacy knowledge.

All participants became aware of themselves as reflective MLS disciplinary readers as they recognized their disciplinary socio-cognitive reading strategies demonstrated both their awareness of the "language of the lab" and their status as a member of the MLS community. Although readers were aware they were reading out loud in front of others, their usage of all the language cuing systems was evident and showed these readers' primary focus while reading was on understanding their disciplinary texts.

The Evolution of Co-Constructing Disciplinary Literacy Knowledge as a Community of MLS Learners

Participants were initially focused on how they could individually benefit from taking part in CRMA sessions where they discussed their MLS disciplinary readings. At the start of the study, I asked specifically what each participant was hoping to learn through their participation. Max noted he wanted to get more exposure to disciplinary vocabulary and disciplinary texts. Norma wanted to learn different reading

comprehension skills from others as way to help with her own reading. Even faculty

professionals had an initial individual focus. While they were hoping to learn how to

better help students, their initial focus was in how they could apply Miscue Analysis to

their own classes. As the study progressed, participants developed a newfound awareness

in how collaborative group learning provided them an avenue to actively engage as

disciplinary learners and build a supportive disciplinary community for each other.

The MLS program included in this study was already a well-established

community. However, many of the ties and supports students had were between members

of their own class and their professors. As students, they did not have many opportunities

for working with other students outside of their own class or with professionals outside of

the program. In the following section I first describe how these participants created an

MLS community with members from all levels of disciplinary experience that allowed

them space to co-construct disciplinary literacy knowledge. I then show how this

community would not have developed without a supportive environment that fostered

each other's disciplinary literacy knowledge as well as how they felt about participating

in CRMA sessions.

As I mentioned earlier, not one of my participants had engaged in a CRMA

session prior to this study. As such, this was new environment for each of them. This new

educational environment challenged them in ways they had not considered, but provided

numerous opportunities for growth as well. I highlight how this community of MLS

readers stepped outside their comfort zone in participating in CRMA but still found value

in considering their disciplinary literacy knowledge in a new light. Finally, I describe

ways in which this MLS community reframed the MLS disciplinary literacy experience

to highlight how CRMA enabled them to co-construct disciplinary literacy knowledge.

Creating a Community of Disciplinary Readers

Participants with all levels of disciplinary experience noted how they preferred

working in their small groups during each CRMA session over their individualized RMA

sessions. Participants were able to create a community of MLS disciplinary readers that

fostered disciplinary literacy knowledge gains through their dynamic interactions. Darrin

felt Miscue Analysis to be a learning experience. Darrin admitted she felt embarrassed

listening to herself read out loud when she initially met with me for her RMA session and

listened to her oral reading. She noted, while it was embarrassing to listen to herself, she

was comforted having the individual RMA session with me first, since we had a history

together. She was familiar with me, and this prepared her for when she later met with her

group. Darrin later noted she was surprised that she enjoyed having her group listen to

her reading excerpt. She commented, "I heard myself and immediately thought how

terrible of a reader I was, but then everyone had so many nice points about my miscue's.

It made me feel so much better…I loved working in this collaborative learning group."

Darrin noted how her CRMA group pointed out they all made similar miscues when

reading the same text and had similar thoughts about why miscues were made. Darrin felt

a sense of comradery develop in her group through encouragement and support.

Lailah recognized it felt a little awkward at first to discuss miscues in front of

everyone in her Team. However, she felt as the Team settled into their discussions, the

process felt more comfortable and natural. Due to Violet's work schedule, she

participated in both Team A and Team B CRMA sessions. Even though she switched

Teams partway through the study, she noted the process never felt judgmental, but rather she felt "normal and understood" by both the Teams. She noted each Team was made up of people with similar interests and disciplinary experiences and found these commonalities were often used as starting points for discussion. Despite this, Violet did note she felt a little more embarrassed when her previous professors, aside from me, pointed out some of her miscues, "that might be due to classical conditioning of not wanting to make mistakes." As noted earlier, Violet developed in her understanding that miscues are not mistakes (Y. Goodman & Goodman, 2013) through her participation in this study. As one of Violet's former professors, Zoe independently considered this idea as well, and noted for some it could be challenging psychologically, feeling they did something wrong with their readings when they miscue. She too initially felt pressure to "read correctly" if others were going to be listening to her, but noted a sense of comfort develop with each CRMA session that passed. As the sessions progressed, Violet acknowledged everyone on the Teams seemed more comfortable with discussing the miscues they made, "this is an environment that is not judging you or scolding you." Bethany similarly added she never felt she was getting picked on or beat up on when discussing miscues. She felt everyone approached the sessions with respect for each other and a recognition that they were all making miscues, both high quality miscues and disruptive miscues (Flurkey, 2020).

The understanding of everyone miscues (Y. Goodman & Goodman, 2013) was an essential aspect for all participants to recognize when we held the CRMA sessions. Participants also began to demonstrate their awareness that not all miscues need to be corrected. During each CRMA session participants discussed the quality of their miscues

and came to recognize disruptive miscues as those which should be corrected. The

current students, similar to the ascending professionals and even the faculty

professionals, noted how they initially felt pressure knowing their oral reading was going

to be played in front of everyone. Mary commented, "I enjoyed listening to everyone's

readings and following along carefully to listen for miscues. It was reassuring to learn

that everyone miscues, including experts in the MLS community." Max similarly agreed

and noted how he liked having readers with varying levels of experience providing

insight into miscues. He enjoyed hearing other perspectives and analysis on his reading as

opposed to solely relying on his own interpretation of his readings. Mary also liked

having a variety of perspectives, but added it "gave me a sense of security to have Norma

and Logan in my sessions." While she enjoyed participating in CRMA, she

acknowledged it was comforting to have people she already knew and had the same level

of experience as she did. Participants across all levels of experience felt comfortable in

discussing their miscues with each other by the end of the study. They felt a connection

to other members in their CRMA Teams. They warmed up to finding ways to support and

learn from each other through their discussions of how they read their disciplinary

readings.

Supporting a Co-Constructed Positive Environment for Disciplinary Literacy Meaning-Making Processes

This MLS community was able to develop through this study because of the

nurturing and supportive nature embodied by each of the participants. Starting in the first

CRMA session with the faculty professionals, I helped set the stage that everyone does

indeed miscue. As the faculty professionals listened to my initial reading and started

thinking about their own readings, they were able to appreciate how a reader's miscues could provide insight into ways they, as teachers, could help their students better understand their disciplinary readings. By the time we had our second CRMA session, current students and ascending professionals were already starting to bond. They were able to do this through constant support and encouragement from their professors/former professors as well as each other. Frequently participants would call out how they loved a certain miscue they heard, or loved how a reader was navigating the text they read. Bethany frequently said things like, "yeah I loved it! I loved it! I love listening to you talk like that!" She was an ardent supporter and encourager to everyone when we discussed their miscues.

The following excerpt from Team B's second CRMA session showed how participants were supportive and encouraging of each other in their discussion of Darrin's oral reading. The microbiology text (Barnes et al., 2017) Darrin read had many terms that were specific to not just microbiology, but mycology, a discrete subset of microbiology that considers fungal elements. Darrin worked very hard to understand the following sentence and chose to read the sentence without the text in parentheses in an effort to make sense of the text (see Figure 12).

Figure 12

Darrin's Abandoning a Correct Form, Omissions, Repetitions, and Self-Corrected

Miscues with Reader Self-Talk
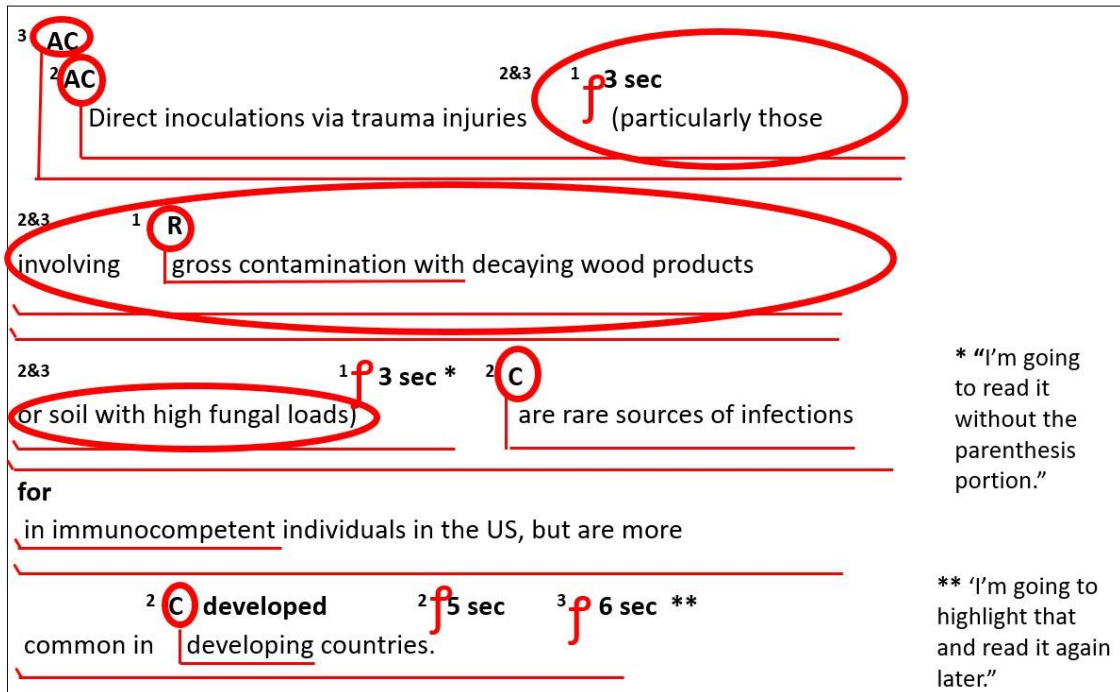
Note: * indicates self-talk. From "A Noninvasive *Rhizopus* Infection With a Bladder Fungal Ball in a Patient With Poorly Controlled Diabetes Mellitus" (Barnes et al., 2017, p. 77).

Darrin's reading of the text (see Figure 12) included self-talk which revealed how she was working to make sense of the text. There was a long section of text included in parentheses. As Darrin came to the end of the text in the parentheses, she paused and then noted "I'm going to read it without the parenthesis portion." At this point, she went back to the beginning of the sentence and reread the sentence without the text in the parentheses, and then continued reading the rest of the sentence. After she finished the

sentence, she paused for 5 seconds and then went back and reread the entire sentence, again omitting the text in the parentheses. After reading through the sentence again, she paused for 6 seconds and then noted, "I'm going to highlight that and read it again later." Team B discussed Darrin's miscues and self-talk from her oral reading during their second CRMA session. They reflected on both how she chose to reread the sentence as well as her self-talk during her reading:

> Norma: I kind of liked how she reread that last sentence multiple times because that parentheses it's just a massive block of text, and makes the text really convoluted. So, I think when she repeated it, it helped make my brain process it better. Because initially, even reading it now, that was kind of confusing to interpret.
>
> Meghan: And you read this text as well, correct?
>
> Norma: Yeah. I remember this, but I still don't know what the sentence is saying.
>
> Darrin: I will say, I did a lot of like flash corrections to myself. I feel like I read it and I'd be like, oh wait, that's not what it says. Almost to the point where I was, like, do I have a stutter that I never knew about because I keep repeating myself.
>
> Mona: I think you did a good job! I agree with Norma on going back and correcting and rereading it until it made sense to you. You were like, wait a minute, that didn't make sense, let me go back and let me reread that. And when you decided, let me take out what's in those parentheses, just so that I can maybe make sense of that sentence, just to understand what it's saying, I thought you did a good job of correcting yourself.

Darrin: Thanks for saying that!

Norma first commented how she liked the way Darrin transacted with the text. She

highlighted how Darrin's transaction was for meaning-making and that she too, had

trouble with the text. By doing this Norma was both encouraging and supporting Darrin.

As Darrin noted previously, this type of encouragement was crucial for her in feeling

welcome and comfortable while discussing her miscues in front of people she had

previously never met. As the conversation unfolded, Mona, a former professor of

Darrin's, complimented Darrin on her hard work in making sense of what she read. This

type of encouragement happened throughout each CRMA session from both Team A and

Team B. Darrin was appreciative of this positive compliment and this encouraged her to

continue to open up and share her thoughts about both her own miscues and others

miscues.

Mona was a continual positive presence throughout each CRMA session. Her

work schedule conflicted at times with our CRMA meeting times, so she, like Violet, was

able to participate in both Team A and Team B CRMA sessions. During the second

CRMA session with Team A, Rylee was challenged by some of the terminology from the

first text she read (Flayhart, 2020). There was a table in the text she read that listed drug-

resistant organisms. The first column of text listed the organisms, the second column

listed the number of cases and the third column listed deaths from the respective

organisms. Rylee read through the table in its entirety during her oral reading. On the

fourth row the text listed the organism "ESBL-producing Enterobacteriaeae [sic]"

(Flayhart, 2020, p. 9). The text had misspelled Enterobacteriaceae. During her reading

she slowed down her speed of reading to process the text. She made a disciplinary

specific prediction for what she expected the text to read, and then integrated her prior

knowledge on the topic to correct the text to make sense. She was able to produce the

correct name of the bacteria, despite the text having a typo. During the group's

discussion, Mona, their microbiology professor, was seen complimenting Rylee on her

efforts.

> Riley: I struggled so much with that word. I thought about it like three times
>
>   before I said it.
>
> Mona: But yeah, you said Enterobacteriaceae correctly! Even though they had
>
>   it spelled wrong in the text – so I want to give you kudos for that!
>
> Riley: I appreciate that, Mona.
>
> Mona: I thought she did a good job navigating those names myself.
>
> Bethany: I think there's no chance a novice would have read it, that well.

Again, this type of encouragement and support from Rylee's professors, helped instill a

sense of pride in Rylee in her efforts toward reading a disciplinary text. This

encouragement created a welcoming environment that allowed each participant to feel

validated in their efforts at reading a challenging disciplinary text and created a safe

space to discuss all miscues, ones that contributed to meaning making as well as those

that may have hindered meaning making.

Throughout this study Team B also created a welcoming learning community that

promoted discussions not only about the miscues each reader was making, but also

showed how they were co-constructing an understanding on the quality of the miscues

they were making. Norma read the same microbiology text as Mary and Darrin (Barnes et

al., 2017). All three of the readers were challenged by many of the fungal terminologies

and medications discussed in the text. During Team B's second CRMA session, Norma's

miscues were discussed (see Figure 13).

Figure 13

Norma's Self-Corrected, Uncorrected, Substitution, and Omission Miscues with Self-Talk

Note. From "A Noninvasive *Rhizopus* Infection With a Bladder Fungal Ball in a Patient

With Poorly Controlled Diabetes Mellitus" (Barnes et al., 2017, p. 75).

When Team B discussed Norma's reading, Violet and Mary noted the frequent

usage of self-talk throughout Norma's oral reading. Violet added she liked hearing

Norma's commentary, especially around many of the complex medical terminologies and

fungal names. Violet agreed with Norma that they were hard. Logan continued the

discussion by noting how many readers will make substitutions and then self-corrections:

Norma: It's like the flow of the sentence in my head, I just kind of auto correct

myself, and then I just keep going. Especially if it doesn't change the

meaning.

Violet: Yeah, I think when people change a word to mean something more in

their head, I think that's a sign that you're actually into the text. That you're

reading because you're able to read it, without actually seeing every

letter…

Norma: That's a good way of looking at that. I like that. I also skip the reference

ranges and anything in parentheses…I would read it in my head. My brain

is just trained not to read that stuff out loud from years of working in tech

theater and following stage directions.

Violet: Yeah.

Mary: The theme that I picked up on is very similar to what Logan pointed out in

Violet's reading. You read it in a way that you can understand it, and

again, not so much as if you're reading it for another person, especially

with the euphemisms in it …it's almost like you're having a conversation

with yourself in a way, and trying to piece it together.

Violet: Yeah, that's true. And I noticed that she was saying things like "highlight

that," and was really concerned that she wouldn't know

something…showed that she actually was interested in having more

knowledge…

Mary: If it makes you feel any better, I couldn't pronounce half of these words,

and I really had a hard time with it…

Norma: Yeah, those antifungals just kill me.

Norma frequently used self-talk throughout her oral readings. Her Team appreciated this

self-talk and considered how this helped them to further understand how Norma was

making sense of the text. Norma's self-talk provided her Team the opportunity to see

how she was responding to the text. In their collaborative discussion above, Norma added

her experiences working in stage theater had taught her to skip over text in parentheses.

This CRMA session created a space for Norma to better understand her own meaning

making processes and metacognitive processes. Even though this sentence was coded

YN- (syntactically acceptable but semantically unacceptable), the entire Team supported

and encouraged Norma in reflecting on her meaning making processes. Mary further

supported Norma when she mentioned her own difficulties with reading many of the

terminologies in the article. This discussion by Team B demonstrated how they were

effectively creating a positive learning community that supported and nurtured their

understanding about disciplinary texts.

Positive Impressions About Disciplinary Reading, the Reading Process, and

Miscue Analysis. This collaborative learning environment allowed participants to be

forthcoming in how they felt about Miscue Analysis, their own miscues, and the reading

process. Participants often expressed their feelings in relation to the miscues, not simply

identifying them, before they discussed them. Many would explain how they "liked"

certain miscues. Each participant had an interest in science and approached our CRMA

sessions with an analytical mindset. They enjoyed not only identifying miscues but

theorizing on why each reader made certain miscues.

I began the second CRMA session discussing the faculty professional's miscues from their oral readings. As everyone in Team A settled into the discussion, Violet noted, "I love all the miscues, they're all fun!" She went on to start a discussion about her "favorite" miscue that she identified from Bethany's reading. As the discussion progressed, she noted how hearing Bethany's miscues, both high quality and low quality, encouraged her in her own reading and she felt more empowered in her own reading.

In Team B's second CRMA session, Mona and Zoe discussed how laughter frequently showed up during the readings they listened to and discussed. During Mona's reading, the text referenced a very large incidence of infection that was upwards of 80%. Mona laughed out loud at the reference and commented on this during the Team's CRMA discussion. A bit later, the discussion turned to Zoe's reading and she similarly laughed during her reading in reference to lab values she read. Mona, noted, "I appreciated your laughter also, at the end of yours, since I did the same thing with mine." Zoe went on to say there was a lot of laughing during her reading. They discussed how their laughter was two-fold. In one respect they were engaged in the articles they were reading and had involuntary laughter in response to what they read as they understood the text and reacted to what it said. On the other hand, they also noted at times they had nervous laughter as they were reading out loud, cognizant that they were being recorded. They were open in discussing their own initial nervousness with their former and current students.

Zoe later admitted it was likely a positive thing for students to see their professors make miscues and not have "perfect" readings. This imperfection can be a valuable teaching point for students. Violet noted during the final CRMA session:

> …seeing the experts in my field – previous professors who I saw, and still see, as
>
> prefect beings in disciplinary reading, make the same and even different miscues
>
> while reading. Seeing them struggle like me made their position seem more
>
> achievable and humanized them even more. It was relieving to see!

Violet's comments support those made by Zoe. Showing the imperfections of the faculty

and how they transacted with their disciplinary texts increased the level of respect other

participants had for them. At the end of the study, Bethany admitted she had fun

participating. She felt Miscue Analysis to be a helpful tool that could benefit students by

identifying where meaning was breaking down and working on finding ways to better

support the students.

All participants, faculty professionals, ascending professionals, and current

students alike warmed up to the group interactions and discussing miscues. Lailah

reflected:

> I feel like in the beginning, especially with the students, I'm not familiar with
>
> them. They're complete strangers to me. So, especially telling a stranger – oh, I
>
> noticed this, instead of that. Versus, after talking with these people for some time,
>
> it makes it easier.

Lailah's comments depict how the participants across the study felt about Miscue

Analysis. As they developed relationships that were encouraging and supportive of one

another, they felt the process of CRMA to be easier and they were surprised by how they

enjoyed their sessions. Darrin noted, "I was like Wow! I actually – I do enjoy everyone's

feedback, and I do enjoy looking at everyone else's miscues as well." This overall

enjoyment of the process was a key factor in having my participants remain engaged

throughout the entire study. Max added he had a greater appreciation for how miscue analysis allowed him to look "at the reader as a whole, as in everything that we read out loud, we read it a certain way for a reason…it made me feel good about myself, because I realized I actually know stuff in the field." Participants noted this positive self-reflection regardless of the level of experience. Students especially were more open to learning and engaging with their disciplinary texts when they had this positive mentality.

Each participant attached sentiment to many of the miscues, and it was often during discussions surrounding high-quality miscues that participants would express a favorable sentiment toward the miscue. When discussions from both Teams included low-quality miscues, the reader was usually the first to note they should have corrected the miscue. It was often at these moments when the faculty professionals, and others, encouraged the reader to consider reasons for the miscue. By maintaining a positive environment, all participants enjoyed the entire process, even when discussing low quality miscues with meaning change.

Stepping Outside the Comfort Zone with CRMA

While participants noted a resounding positive experience through their participation in Miscue Analysis, it was not without challenges. None of the college students or ascending professionals had spoken in front of large groups of people on a daily basis. To be engaged participants, they not only had to share their oral readings of challenging disciplinary texts, but then also discuss their miscues. Mary noted, "Talking about my own reading and trying to analyze why I had certain miscues was out of my comfort zone." Other participants also noted this idea of stepping outside their comfort

zone. Norma admitted she was generally a shy person, and while she appreciated having

her classmates with her during the CRMA sessions it was still a bit daunting. She noted:

> Pointing out miscues was a little difficult for me. For one, I'm a little
>
> apprehensive speaking in groups in general, so today was something outside of
>
> my comfort zone. Second, it can be hard for me to process auditory information
>
> sometimes, so it was hard for me to hear some of the miscues. But, having other
>
> people in a group point them out helped to clue me in to them.

She did note by the end she felt more comfortable with the process and did enjoy

participating in each of the sessions. She felt the collaboration that occurred throughout

each session to be helpful. By the fourth CRMA session she noted, "I remember it was a

little challenging for me to open up and talk during the first few sessions, but these group

meetings have really helped me get out of my shell." She felt empowered to be more

vocal in her opinions of the disciplinary texts that were read. In doing so, Zoe noted she

felt Norma had a good eye for editing and suggested she try that out. This revelation

would likely not have occurred if Norma had not stepped out of her comfort zone and

participated in CRMA.

Norma specifically noted throughout the study how she experienced her

participation in CRMA sessions as helpful in building her confidence for speaking in

front of a group. Her experience in getting out of her shell specifically points towards

how these MLSs were able to come together as a community of disciplinary readers that

supported and encouraged each other. Through their interactive conversations during

each CRMA session, they were able to co-construct disciplinary literacy knowledge.

These opportunities came about because each CRMA session was created as a safe

environment for participants to share their developing understanding of the disciplinary

reading process and discuss their understanding of their disciplinary readings.

Successes and Challenges When Transacting with a MLS Disciplinary Reading Revealed Through CRMA. By engaging in multiple CRMA sessions, participants were able to identify both successes and challenges while engaging with their MLS disciplinary readings. All the CRMA sessions occurred using the Zoom platform and as such there were inherently technical difficulties noted. Rylee noted she had some connectivity issues at times. Multiple participants had trouble at first hearing some of the recordings while listening for miscues. Mary noted, "when listening to the readings of pieces I hadn't previously read, I found it more difficult to quickly comprehend the points discussed in the piece while simultaneously trying to listen for miscues." Darrin felt similarly, noting how she felt she was a slower reader, but added she appreciated hearing each reading multiple times. This gave her time to process what she was hearing.

As a solution to the difficulties with hearing each other's recordings, everyone agreed to have the audio of their readings sent out by email ahead of time so they could listen on their own computers. I named them reader one, reader two, etc., so there was no name associated with the oral readings or attached to any of the miscues. I also provided a copy of the disciplinary text each of the reader's read out loud, so everyone could take as long as they needed to read through it. Participants were thus able to read the disciplinary text independently first and listen to the audio recordings of the oral reading samples to be discussed during the upcoming CRMA sessions. This small modification was paramount to increasing participation. Everyone was able to better hear the recordings and took their time to identify miscues. This led to more fruitful CRMA

discussions as well, as each participant came ready to discuss their miscues. Everyone agreed they enjoyed discussing the miscues and this small change allowed more time for discussion during each CRMA session.

Other noted challenges specific to their MLS disciplinary readings were revealed and discussed during each CRMA session for both groups. Bethany noted the most profound thing she learned was about Max and roman numerals. He revealed he had never learned roman numerals prior to our MLS program and he had to spend extra time learning them to understand the coagulation pathways he was taught in hematology. Bethany had never considered someone would not know these and saw how this small piece of information was crucial for a student to understand coagulation. This disciplinary-specific reading challenge would not have been made apparent without CRMA.

Time was another frequently mentioned barrier to completing MLS disciplinary readings. Bethany recognized time management could be difficult especially for students. Logan noted much of his time and energy at the time of the study was devoted to understanding his STEM readings and it was hard to balance with his pleasure reading and writing. Darrin added she had to read disciplinary articles frequently for her work. She would prioritize them so that she could be sure to devote enough time to read and reread as needed. She added, "I almost can never get it right, like, the first time, I'm always going to miss something. So, I make sure I put a lot more time to those types of reading." Simply recognizing the time necessary to complete needed disciplinary readings was important for these participants. They felt justification in the time they devoted to understand a text.

Lailah noted after the third CRMA session how she felt encouraged hearing everyone's readings and miscues. She felt MLS disciplinary readings could be challenging due to the amount of jargon, in-depth material covered, and vocabulary. She felt understanding these things was necessary to understanding the bigger picture of what an article was trying to convey, and at times she would have to work harder to understand. Through her participation in CRMA she was able to see how even the expert faculty professionals in the study had to work hard to understand disciplinary texts. Bethany added how the complexity of abbreviations used could be challenging, "the abbreviations, I think, are necessary because the names of them are so long. But that absorbing those abbreviations, all in the same place is challenging." For this MLS learning community, making the idea of what could be challenging in a text an explicitly discussed topic, helped to create a space for them to consider how they could turn these challenges when reading their disciplinary texts into successes.

This MLS community demonstrated their collaborative growth as they worked through their miscue discussions. Many participants initially viewed their miscues as mistakes, but through their participation in multiple CRMA sessions their perceptions about miscues changed. They began to appreciate how their high-quality miscues revealed their disciplinary knowledge and their usage of socio-cognitive reading strategies to make sense of their disciplinary readings. This was a significant change in the evolution on how this MLS community was able to co-construct their disciplinary literacy knowledge.

Reframing and Enriching the MLS Disciplinary Literacy Experience

Participating in CRMA sessions allowed this MLS community to reconsider their MLS disciplinary literacy experiences. Prior to the study, they felt their disciplinary reading to be a solitary activity. By coming together and discussing how each of them were transacting with their disciplinary texts and coming to understand the concepts portrayed, they were able to shift their thinking and imagine how collaboration could improve disciplinary literacy knowledge. Logan noted how he was more aware of others perspectives when reading:

I liked the interaction between the experts and students. I thought it gave a different perspective and definitely made me consider a few things. For example, when Mona had mentioned that she was used to having more detailed patient backgrounds and how she would have preferred more of such in this journal. Before she said that, I had assumed that most people would have been okay with the information given or, like me, thought that a lot of it was just extra and not necessary.

Logan referenced a commonly used disciplinary journal used by MLS professionals, *Lab Medicine*. The journal consistently presents case studies in a singular format, but Mona desired more background information to support her understanding of the case presented. Logan noted throughout the study how he enjoyed both reading and writing, and language itself was an interesting topic for him. Through CRMA he was able to recognize how other readers may come to understand a text differently then he would. He noted he could use this information to help him become a better disciplinary writer, by acknowledging everyone has an individualized transaction with a text and as a writer

what he feels to be clear may not always be so for other readers. For him, this experience made him aware of an explicit literacy aspect he could work on in his disciplinary writing.

Students were not the only participants to reconsider their approach to disciplinary literacy experiences. Zoe noted, "it is an interesting window into how we interact with and understand our disciplinary texts!" Zoe was open to reflecting on her own teaching practices and learning what she could take from her participation in CRMA and use to help students increase their disciplinary literacy knowledge. She acknowledged students read and learn in multiple ways so that, "learning all, or many, possible options will be helpful for constructing teaching exercises or at least knowing how to frame a discussion about reading." Participating in CRMA sessions allowed Zoe to consider her approach to each student in an individualized fashion. Miscue Analysis afforded her the ability to consider how to develop student-centered disciplinary reading assignments. She recognized she could tailor her instruction to meet her students' needs and interests and foster student growth and disciplinary literacy knowledge development.

Transforming Perspective on Group Learning Through CRMA

As participants began to consider their disciplinary literacy experiences in new light, they subsequently came to reconsider the role group learning could play in those disciplinary literacy experiences. As noted previously, participants had never engaged in CRMA sessions prior to this study. Many overcame insecurities they felt in not only speaking in front of a group but discussing their oral reading and comprehension of disciplinary texts. Bethany acknowledged the importance of having readers with more experience go first in group discussions to allow students the chance to increase their

comfort level prior to being the focus of analysis. She noted, "I thought you set the stage well, this is not a mistake, this is a miscue, everybody does it. I thought you were smart to do the experts first, so that they could see that we did it too." Bethany regularly used group work to support student understanding of disciplinary concepts. She acknowledged even in groups of their peers, students initially would be hesitant to share their thoughts. She recognized the importance of having the faculty professionals' oral reading samples analyzed first to foster student participation. Zoe and Mona also used group work in their classes, but not to the degree that Bethany did. All three faculty professionals, Bethany, Zoe, and Mona, recognized the importance of group interactions in supporting disciplinary literacy and were open to finding new ways to support group interactions.

Violet acknowledged it was easier to identify miscues other readers made and have her own miscues pointed out as the study progressed and her comfort level increased. She did not perceive Miscue Analysis as a form of judgement, but felt everyone in the groups were studying each other's miscues purely out of interest for what they could reveal. Many participants were surprised by how much they enjoyed discussing miscues. Darrin noted:

> …it's nice when other people give you that feedback, and then for me, I think I emailed you when we were listening to my reading, I kept stuttering. And I was like, oh my gosh, this is so embarrassing, I don't know how to read. You know the feedback immediately after, everybody was like, oh, it's okay! I made that same miscue or I thought the same thing and I like that you corrected yourself…so that was nice.

Darrin was not expecting to have such a positive experience in a group setting. Darrin initially was apprehensive about having people hear her miscues noting the fewer people that knew about it, the better. She was pleasantly surprised by how much she enjoyed her interactions and what she was able to take away from the group collaboration.

Violet also enjoyed the group interaction more than the individual RMA session, since she had the opportunity to hear other's thoughts, experiences, and interpretations while being able to compare them to her own. She further reflected:

I felt less alone in any struggles. I learned a lot with the groups input. Being in the group made me learn more about myself than I learned alone. When you get to compare yourself to others, that when you see where you stand, like points on a graph…It definitely humbled me in my thoughts on my reading abilities, but it also showed me where my strong suits are and how to use them in my profession. I recognize more that it doesn't hurt to reread, and that everyone at all levels can miscue just as much as the next person. I know what it takes for me to get the most out of a text.

This ability for Violet to see how she compared to others was universal among participants. Darrin similarly acknowledged she used to think everyone read more efficiently than she did and without mistakes. She realized she was simply not seeing them read. Seeing "us all kind of make the same kind of observations or the same miscues, we think about it in similar ways. I think that made me be like, okay, you're not alone." Darrin preferred thinking about her miscues as such and not calling them mistakes. As a child, she was aware of her own struggles with reading and had always felt herself to be inadequate. Her participation in CRMA sessions shifted her perspective

of herself and she came to understand how her miscues revealed her strengths. Violet and

Darrin had not previously considered the value they would place on group learning.

Darrin noted she found it helpful to talk about MLS reading and she enjoyed seeing how

her work in the profession enhanced understanding across multiple MLS disciplinary

readings. Both Darrin and Violet felt reassured in how they were reading and coming to

understand their disciplinary texts like their peers. This shifting perspective on group

learning helped to boost confidence among all participants.

The current students had a similar boost in their confidence through their

participation in group CRMA sessions. Norma noted how she felt better about herself and

how she approached reading her disciplinary texts. Mary added the group CRMA

sessions helped in her confidence as a reader. Initially Mary noted she would feel a bit

intimidated by some of her disciplinary texts even before she would start them. Through

our discussions during each CRMA session, she felt more willing to take risks with her

disciplinary readings and was open to considering how she was interpreting her

disciplinary texts. The students in this study found their initial interpretation of group

learning shift away from an anxiety-producing activity that highlighted their faults or

misunderstandings. Students began to consider group learning as a supportive

environment that fostered their disciplinary literacy development as they continued to

thoughtfully engage with each other.

Critical Analysis of Disciplinary Text

As participants became more comfortable with discussing their miscues in each

CRMA session, they also began to consider the role of the text in either fostering or

inhibiting a reader's understanding. Conversations began to shift toward a critical

analysis of the disciplinary texts they were reading for this study. The faculty

professionals were not shy with their critiques of the texts read. Bethany acknowledged it

was mature of the students to start to question their disciplinary readings. She noted, "I'm

not sure at your stage I would have even thought that! I would have thought, these are the

experts, I'm supposed to learn here from what they're saying." Bethany felt this was a

revelation the students would not have gotten in another way. Their participation in

CRMA sessions provided them an opportunity to consider their disciplinary texts

differently than they had previously.

Mona, as a faculty professional, considered how Miscue Analysis could provide

insights into the readability of a text. She noted she screened disciplinary texts and

articles she shared with her students, and she had never considered giving them a poorly

written article to discuss. She was interested to see how providing students a "bad" article

could help them learn to be critical consumers of their disciplinary texts. But Mona was

cautious in having students be too critical of disciplinary texts:

> I guess the critiquing comes just from experience and not being a novice anymore.
>
> Isn't that just part of the development? I'm not sure how critical I would have
>
> been as a novice. I'd have been thinking that I was getting too big for my britches.

Mona believed students could benefit from discussing how they were coming to

understand their disciplinary texts together. However, she worried without guidance from

someone more experienced in the discipline, students may miss critical information or

misinterpret key aspects. She appreciated how Miscue Analysis could provide a new

avenue for her to discuss disciplinary texts with students.

Lailah admitted she initially felt the authors of the disciplinary texts were the experts and asked who was she to question what was written. However, the fourth CRMA session with the second oral reading samples from each of the college students shifted her thinking as consistent miscues were noted from each reader. For this CRMA session, each of the college students had read the same disciplinary chemistry text. At this point, Lailah began to question the readability of the article itself. She acknowledged she likely would not have come to this conclusion without her interactions in Team A. She noted she would have thought difficulties were just internal to her and a lack in her own knowledge. Lailah also felt the type of miscues that were occurring could reveal how accessible a text was to different audiences.

Logan also felt the second disciplinary chemistry text read by each of the college students was difficult to follow. He felt his thoughts on the article were validated by hearing his group discuss similar difficulties when transacting with the text. Logan was cautious in how Miscue Analysis could help evaluate a text and its readability though. He felt miscues to be subjective to the reader, a reader could have many miscues but still have a good grasp on the text while another could read flawlessly but not understand a lot. He noted "if a lot of readers have consistent miscues…then I think it does reflect that the text may be flawed in that sense." Here, Logan showed an awareness into how Miscue Analysis can provide insights into not just a reader's meaning making processes but also the readability of a text. Mary also began to question the reliability of a text, "because I think I never really did that. I just always assumed, take what you get, but you don't always – you don't have to do that." Through CRMA sessions, Mary gained confidence in her own interpretations of disciplinary texts. Mary added she could see

herself analyzing her disciplinary texts and articles more carefully as she began using them for continuing education opportunities after graduation.

In Team B's fourth CRMA session, Mary reflected with her group on the second chemistry text, "I didn't really like the wording of the piece…for me it didn't flow well, especially reading it out loud." If Mary had not read the article out loud, she may not have recognized the difficulties she had to overcome to understand the text. Norma also felt many of her miscues stemmed from the article failing to present the information in a cohesive fashion. She added she would have loved a red pen and a quiet space to fix the article. The chemistry text the students read had two tables, a chart, and two pictures across five pages of text. Norma noted the text referenced the second table on the first page, but it did not appear until the fifth page. She had to continually scroll back and forth and felt this impeded her ability to understand the larger concept the article presented. This is consistent with previous studies that have shown images must be accessible to the reader to support understanding (East, in press; Kress & van Leeuwen, 2006).

Through their supportive and nurturing interactions, both Teams of MLSs came together to create a community that thoughtfully discussed their disciplinary readings. Participants' confidence in how they viewed themselves as disciplinary readers increased and they came to appreciate how Miscue Analysis in a collaborative group was a beneficial tool for them to learn from each other and increase their disciplinary literacy knowledge.

Apprenticeship of College Students into MLS Disciplinary Literacy Practices

Each participant gradually began to recognize the importance of apprenticeship as it relates to their disciplinary literacy knowledge as the CRMA sessions developed throughout this study. This MLS collaborative learning community considered what apprenticeship meant to them and how it manifested in their disciplinary literacy activities. This community viewed apprenticeship as a form of directed guidance into the inherent ways of the discipline. Considering this from a literacy perspective, they viewed apprenticeship as guidance on how to read or write as an expert in the field.

All the participants were aware from the start of this study that they were helping to provide a better understanding into how this MLS community transacted with their disciplinary texts. In doing so, areas where readers were being challenged by their disciplinary texts were identified by each group: college students, ascending professionals, and faculty professionals. I then presented these specific areas mentioned by the college students and ascending professionals back to the faculty professionals. The faculty professionals considered how this information could help inform their curricular decisions for this MLS program to lead to positive changes and reinforce meaning making purposes while reading. Toward the end of the study, participants from both Team A and Team B CRMA sessions were identifying areas of need that would help support this MLS community's curriculum.

A key discovery was students' desired apprenticeship of their MLS disciplinary literacy practices. I first describe the collaborative recognition amongst participants for apprenticeship and discuss how participants already saw apprenticeship happening in the discipline, then share their suggestions to increase apprenticeship opportunities of their

MLS disciplinary literacy practices. Participants also came to recognize how they envisioned themselves fitting into this structure and the role they would play.

A Collaborative Recognition on the Need for Apprenticeship of MLS College Students into the Disciplinary Literacy Practices

When I met with participants for the final CRMA session, I presented the idea of apprenticeship back to them to solicit where each felt apprenticeship of the disciplinary texts should occur in the MLS program and also asked them where they felt apprenticeship of their disciplinary readings was already occurring. The fifth and final CRMA session was broken down into three separate groups based off of experience. I met with the college students first, followed by the ascending professionals, and finally the faculty professionals. By having the faculty professionals go last, I was able to provide them with insights and suggestions from their current and former students. I separated each group down by level of experience to increase honesty and thoughtful reflections and to avoid participants, especially the current students, from feeling pressured by their professors.

Individually and collectively, college students identified areas where they felt apprenticeship of disciplinary literacy practices would be helpful. This need for apprenticeship was further recognized by each group of participants, college students, ascending professionals, and expert professionals. The two primary areas college students and ascending professionals independently identified as potential areas for opportunities of apprenticeship in disciplinary literacy practices were reading their disciplinary research articles and disciplinary procedure manuals. Each group was also able to

identify where they felt apprenticeship of disciplinary literacy practices was already

occurring in this MLS program.

Disciplinary Research Articles as an Area of Need

When the college students considered specifically text-based reading instruction

in the discipline, there was consensus on the lack of any direct reading instruction or

guidance. Norma felt comfortable in regards to the approach she took toward reading her

textbooks, but noted she would like guidance for navigating journal articles. Norma

recognized while her approach to her disciplinary textbooks was not perfect, and there

were times when she lost meaning while reading, she was happy with her current usage

of disciplinary textbooks. She believed a bigger struggle was in coming to navigate and

understand disciplinary research articles. Rylee similarly felt a desire for more direction

when looking at research articles and noted simply approaching some articles could be

intimidating. All the students were quick to note while they wanted guidance on how to

approach disciplinary articles, they did not want the material dumbed down for them.

Norma noted she would feel "personally insulted" if a disciplinary text was not kept to a

certain standard. Max similarly felt the disciplinary texts were preparing students to enter

a higher level of expertise and as such students needed to work to understand their

disciplinary texts. All the students enjoyed the challenge of coming to understand their

disciplinary texts and wanted to be able to rise to the level of the text. However, they did

desire more training from a disciplinary mindset on how to approach their disciplinary

texts. Max felt he was a hands-on learner and he did not want to be simply told how to

read something, rather he wanted the specific guidance on what he should be looking for,

what was important for the discipline. He reflected many research articles he would just

skim through and skip a lot of the sections that discussed the actual testing. He noted as

his knowledge about the discipline grew, he was able to understand more of the what

articles he read were saying. He added it would be helpful at the start of the MLS

program to sit down with students and go through an article slowly, highlighting what

was important to consider and what they should be looking for.

Darrin noted in her current job she was responsible for validating new procedures

they wanted to bring in-house. The lab Darrin worked at was regularly researching and

testing new methods to test for COVID-19. Each of the methods was slightly different in

how it would test a patient for COVID. To understand the methodologies of each test she

had to regularly read challenging disciplinary articles. She noted multiple times

throughout the study how she would sit down with her supervisor to review these articles.

She reflected this type of apprenticeship was beneficial to her as a recent graduate and

acknowledged it would have been helpful to have similar guidance as a student.

Navigating Disciplinary Procedure Manuals as an Area of Need

A central MLS disciplinary text noted by each participant was procedure manuals,

also referred to as standard operating procedures. Each laboratory procedure performed

by an MLS includes a written explanation of the methodology behind the test, how to

complete the test (like a cookbook recipe), and any special considerations such as false

increases or decreases or ways of reporting results. Darrin recognized the importance of

being able to read each procedure manual that describes the steps necessary to complete a

laboratory. All participants similarly described procedure manuals as a specific type of

disciplinary reading that was integral to the profession. Darrin felt when she was a

student it was helpful to have the procedures ahead of time with the expectation that

students would read over them and come prepared to each lab. She recalled a few times where she would go to a professor's office for clarification on a procedure for an upcoming lab. She felt when she would approach her professors in this one-on-one environment, she would receive a more direct review of the reading and specific guidance about details of the procedure she had questions on. For example, what reagents a particular procedure used. Darrin felt this type of apprenticeship, of reading procedure manuals for her student labs, was crucial for her success. She noted a desire to have more of this type of guidance on a broader range of disciplinary texts when she was enrolled in the MLS program.

Recognizing How CRMA Further Supported Apprenticeship in the MLS Program

While the college students and ascending professionals focused on the need for apprenticeship of disciplinary literacy practices, CRMA enabled all three groups to identify where they felt apprenticeship was already occurring. Ascending professionals and college students brought forth their ideas on where apprenticeship of disciplinary learning was occurring and then faculty professionals added in their perspectives for each. Ascending professional and college students considered how faculty monitored their understanding of their disciplinary text through discussions and question-and-answer assignments. They also appreciated the multimodal nature of their MLS readings and saw how they were receiving guidance on learning to use these types of readings. Finally, the groups also considered how they saw modeling in the classroom occurring.

Monitoring College Students' Understanding of Disciplinary Texts

In the final CRMA session I held with the ascending professionals, they discussed similar ideas about their disciplinary reading instruction. Violet, like Norma, noted while

she felt comfortable in her own approach to her disciplinary textbooks, she did recall how

her professors would provide guidance, although not always in a direct form. She

recalled:

> We were never told this is how you should read our disciplinary text. Messages
>
> were definitely sent to us to value the big pictures and values or findings of tests.
>
> They trained us to look for certain info like 'female who came into the ED whose
>
> hemoglobin was 8 mg/dL and an MCV of 68 fL'…through all the questions and
>
> homework our brains have been trained to pick out key points.

Violet noted her professors did question her understanding of readings through

discussions or direct question and answer assignments. She also considered the exams

she took as a way of checking her understanding of various disciplinary texts. She

recalled her professors would point out specific features from a text, such as a figure or a

chart. Violet also noted how each course would highlight pertinent lab values from any

readings that were significant for what was being studied. She considered these to be

specific guidance from her professors on her disciplinary readings. Violet considered the

way her professors helped her to navigate disciplinary readings to be a form of

apprenticeship into the disciplinary literacy practices that she currently used as a

practicing MLS.

Bethany admitted she did not feel as if she taught them how to read directly,

especially laboratory procedures, but she noted she would have accountability for them in

their reading assignments. She added she would ask them a handful of questions on what

she felt were the important points from the procedures. This question-and-answer type of

guidance was recognized by Violet as a form apprenticeship into how a MLS would

approach a disciplinary text. While Violet acknowledged this type of guidance, not all

students recognized this non-explicit instruction.

Apprenticeship to Foster College Students' Multimodal Disciplinary Reading

The college students did not consider their disciplinary literacy practices to be

solely text based. Congruent with views of MLS disciplinary literacy practices as being

multimodal (Camillo, 2019), they recognized areas in their instruction where they were

being taught to "read" as it applies to the discipline. In the final CRMA session with just

the college students, the conversation turned to specific examples where they identified

specific instruction or guidance on reading in the discipline.

The examples the college students provided demonstrate the multimodal nature of

reading in the discipline and show the value they placed on it. Using the microscope is a

common practice for an MLS. Students in the MLS program receive guided instruction

over the course of two years on how to analyze peripheral blood smears and complete

differentials to aid in the diagnosis of a patient. One way to use the microscope is to view

peripheral blood smears. A peripheral blood smear (PBS) takes a drop of blood, smears it

across a microscope slide, stains the slide to make the cells appear colored, and then the

MLS will view the slide. MLSs do this to look at the types of cells that are present in a

patient. This test is used to identify when someone has a leukemia, a cancer of the white

blood cells, or to diagnose an anemia, such as iron deficiency anemia or sickle cell

anemia. A PBS may also include a differential which classifies each type of white blood

cell as a percentage. A differential is frequently referred to simply as a diff by most

MLSs. Mary reflected on this instruction "diffs – so many diffs! They were very helpful,

though, both in clinical and in the student lab." Mary reflected on how she had a large

amount of practice from both her professors and MLSs at her clinical rotations in learning

how to "read" a peripheral blood smear and complete a differential. Mary recognized that

her professors were supporting her in non-text based disciplinary reading, enabling her to

"read" a microscope slide.

During the final CRMA session the students continued to identify ways they felt

they received direct guidance on non-text based disciplinary reading. Max went on to add

"plate reading, what to look for and how to narrow down what list of possible organisms

there is." Max's reference to plate reading was the instruction he received in his

microbiology classes and labs. When there is a concern for an infection in a patient, a

specimen, for example urine, may be sent to the lab to culture. The MLS will inoculate

the appropriate culture plates and incubate the plates to see if any organisms, such as

bacteria or yeast, will grow. Experienced professionals often can look at how a bacterial

culture is growing, for example the color and size of a colony, and be able to preliminary

identify the type of bacteria present. One of the components of student labs is to provide

students the opportunity to learn to read microbiology plates like a professional. Max's

comment above demonstrated how he used the instruction he had on reading plates to

know what the color and size of a colony indicated. Throughout their courses the students

have many laboratory sessions where they practice "reading" microbiology plates and

performing follow-up confirmatory testing. Both Mary and Max recognized their

disciplinary literacy practices included multimodal reading and were able to provide

tangible evidence of the instruction they received. Mary concretely provided her

experiences with reading PBS slides and Max reflected on his experiences reading

microbiology plates.

Zoe reflected on ways she incorporated instruction and guidance of disciplinary literacy practices that were not solely text-based. Like Mary and Max, she too considered plate reading and cell identification to be specific examples of how students were being apprenticed into the disciplinary literacy practices. She noted:

> even things like looking at plates for Microbiology. Interpreting and reading the organisms that are on the plates. Or looking at slides – peripheral blood smear slides and the cells that are on that and reading and interpreting what those are.

Zoe did not view reading in the discipline as solely text-based, but recognized the importance of multimodal reading for the discipline. She noted she purposefully modeled some of these multimodal disciplinary reading practices when she was in the lab with students. She walked students through plate reading in microbiology and would highlight to students what they should be attending to. She frequently guided the students back to their disciplinary texts when they had questions about bacteria and would connect what they were seeing on microbiology plates to flow charts used in identifying bacteria. She felt this type of apprenticeship was important to be successful as an MLS and worked to find ways to incorporate this into her teaching.

Demonstrating Disciplinary Literacy Practices in the Classroom

Students identified their classroom instruction as a form of modeling during each of the CRMA sessions. They took on the ways of speaking like their professors. This awareness into how an MLS would use disciplinary terminologies played out during their oral readings. Both Teams noted many of their miscues were rooted in the conventions of speaking in the lab. Students learned how to use these ways of talking based on their classroom instruction. Throughout the CRMA sessions both Teams recognized and

reflected on how this form of apprenticeship into the disciplinary literacy practices

fostered their sense of community and co-construction of disciplinary knowledge.

During the fourth CRMA session, Max, in Team A, was similarly able to identify

where he felt modeling of disciplinary literacy practices occurred in the MLS program.

Max was leading the discussion of his miscues from the second text he read aloud. He

noted he omitted saying the full names of two chemistry tests listed and chose to say just

the abbreviations of the tests names that were printed in parentheses. He determined this

did not change meaning in the text and Bethany agreed adding it made the meaning

clearer for a professional audience. He connected his preference for using the

abbreviations to his instruction in the classroom. Max noted:

> The only time I've ever seen the whole words written out and actually heard the
>
> whole words being said out loud were when we first learned about them. But after
>
> that we only ever referred to them as AST and ALT. And I think anyone in the lab
>
> would understand what I'm saying when I say AST and ALT, but if I had said the
>
> words out loud, I think it would have taken another MLS a second or two to kind
>
> of think about, it and piece it together as being AST and ALT.

Rylee's oral reading of the same text had similar miscues, only referring to the tests by

their abbreviations, AST (aspartate transaminase) and ALT (alanine transaminase). When

we discussed them during this same CRMA session, she continued to only refer to the

tests by their abbreviations. During Team B's fourth CRMA session, each student had

similar miscues where they used AST and ALT preferentially over the longer chemical

names. Norma noted she felt it made the text more clear to use the abbreviations. Mona

added she was also more comfortable using AST and ALT, and felt if someone used the

full names, she might not immediately understand what they were referring to. Bethany

added when she taught a class, she would say the full test names while they were

learning, but once she felt students were able to connect the full test name to the

abbreviation, she would switch to just using the abbreviations. She noted she would never

say the full test names when talking to another professional. As senior college students,

Max and Rylee both had acclimated to solely using the abbreviations of the test names.

This was possible due to the apprenticeship they had received in the MLS program in

relation to their disciplinary literacy practices.

Collectively Identifying Opportunities for Apprenticeship of College Students into MLS Disciplinary Literacy Practices

Throughout the study participants from each level of disciplinary experience

identified not only where they saw apprenticeship of disciplinary literacy practices

occurring, but noted where they felt opportunities for apprenticeship could be enriched.

Consistent with the multimodal nature of the discipline itself, participants also discussed

how apprenticeship of disciplinary literacy practices could be helpful in a variety of

settings, not just in learning to read and understand their print-based texts, but also

reading slides and culture plates. The ascending professionals also specifically reflected

throughout the study on what would have been helpful to know as a college student and

how they saw themselves playing a role in apprenticing someone less experienced on

MLS disciplinary literacy practices.

Co-Constructing a Deeper Understanding of Disciplinary MLS Laboratory Procedures

Each group of participants, college students, ascending professionals, and faculty

professionals, considered how their involvement in CRMA sessions revealed

opportunities for apprenticeship of disciplinary literacy practices. They were able to

collaboratively develop ideas on how apprenticeship could foster college students'

understanding when reading disciplinary laboratory procedures.

College Students' Experiences with Laboratory Procedures. During the final

CRMA session with just the college students, Norma noted she felt Miscue Analysis

provided a means for explicit guidance on their disciplinary reading to occur. She

envisioned the MLS program using Miscue Analysis to help students with reading their

laboratory procedures. She recalled a chemistry lab where most of the students

mistakenly boiled their DNA specimens they were working with. Max laughed and added

"I can almost promise you a miscue led to that!" As the group laughed over the incident,

they simultaneously considered how important it was to understand their laboratory

procedures to be able to get accurate and reliable results. The group went on to describe a

desire for more explanations and guidance when they were preparing for their laboratory

sessions. Especially when the lab entailed a new procedure. The students felt discussions

like they had while participating in the CRMA sessions for this study would be helpful

for them to both engage with each other and their professors to better understand their

disciplinary texts, in this case a laboratory procedure.

Ascending Professionals' Experiences with Laboratory Procedures. During

the final CRMA session with the ascending professionals they similarly broached the idea

of having a professor provide more of an apprenticeship into the MLS disciplinary

literacy practices. Lailah brought up the importance of procedures and felt this to be a

specific area that could use more guidance. Lailah noted:

> I think teaching or modeling how to read, is probably really important. I think
>
> back to when we were students in a lab trying to perform a test with just
>
> instructions, and at the time, because we were learning, it felt like it was a
>
> challenge. We had to make sure we're doing the right things and we're reading it
>
> correctly, because that would affect how things play out in the end. I feel like
>
> that's something that's definitely important to the discipline.

Lailah went on to consider the first thing a new MLS professional would do is to read

through all the procedures for the lab they would be working in. She added having

colleagues with more experience that she could ask questions about procedures to ensure

her understanding was an essential part of her own success in adapting to a new

laboratory. She enjoyed being able to collaborate with her peers in this way. Darrin and

Violet agreed and both recognized the importance of understanding their procedures and

being provided the opportunity to discuss any questions they had before they performed

them. Darrin added as a MLS professional she would not run a procedure unless she was

sure she understood what she was doing and that she would perform it correctly. She was

thankful she had a supportive laboratory that she worked in to help answer any questions

she might have. All three recalled their experiences as students in the MLS program

could have been enhanced by a more detailed apprenticeship into the approach used by

their professors in understanding their disciplinary procedures.

The three ascending professionals in this study all considered the role they could

play in providing apprenticeship opportunities to college students as well. They were no

longer in school themselves and were not professors in the MLS program. Following the

third CRMA session Lailah reflected on the benefits she felt through her participation in

this study. She noted, "I think this exercise has allowed me to be better equipped to

bridge gaps along different levels of expertise within the MLS discipline." She saw

herself as an important connection between the novice student level and the more

seasoned expert professional level. She noted when someone with less experience would

come to her with questions, usually in regards to a procedure, she felt it important to

ensure their understanding of what they had read. She added she would reference them

back to a procedure as needed and talk out areas of confusion with them. She noted how

her own experiences with her more experienced colleagues doing similarly had been

beneficial and could see herself engaging in similar activities with students or new

graduates.

    Violet also saw her role as an ascending professional as an important connection

along the novice student to expert professional continuum. She called herself a bridge or

middle ground. She noted, "I am open minded and can see both points made from the two

groups. I am also in a malleable stage of my life where I am reminded of the student

thought process but striving for expertise." Violet noted how she enjoyed sitting down

and reviewing procedures with students as needed. She felt the experience kept her fresh

in the discipline. Violet, along with Lailah and Darrin, felt their role was important for

apprenticing new students. They themselves were not far removed from being a student,

but had more real-world experience and knowledge to connect to their disciplinary

readings. Through their participation in each CRMA session, all three of the ascending

professionals felt they were able to use their personal disciplinary knowledge and

experiences to help foster student learning. They each felt using Miscue Analysis in the

laboratory as a recent graduate could be beneficial. They enjoyed the opportunities they

currently had to apprentice students and wanted to be able to provide more chances for

similar interactions with the students that may intern in their labs

Faculty Professionals' Experiences with Laboratory Procedures. The last

group I met with for the final CRMA session was the faculty professionals. Each of them

was a faculty member in the MLS program in this study and each was interested to hear

what their students and former students suggested to increase student success when

transacting with disciplinary texts. I brought up the idea of more direct guidance on

reading laboratory procedures, especially on procedures they had never encountered

previously. All three of the expert professionals considered this and reflected on how this

could be incorporated into the MLS curriculum:

Bethany: I wouldn't have picked up on, unless you had said it, about procedures.

Zoe: And I guess my question with that, is that something we would do in

         the first semester. Kind of like, okay, here's how this works, here's how

         we do this. You read these procedures and how we read through them.

         With the understanding that it will then carry over to the next

         semesters?

Mona: If you think about it, when we get ready to train on a new procedure in

         the real world, we just don't throw them at the procedure and say here

         read it and now we're going to do it. I think it's helpful if we kind of

         kind of talk about it first. When we started MALDI, we talked about it

         first, this is the principle, this is what we're doing, this is the procedure

         stepwise. So, there was a lot of engagement in what we were going to

         do, and why we were going to do it, before we converted. All of this is

new procedures for them [students]. I know that we don't have the

luxury of time and being able to do that, but I do think there is

something to be said about having that engagement of talking about it

before you're actually expected to do it.

Mona considered the students desire for more direct apprenticeship when transacting with

their disciplinary texts. Specifically, how students mentioned wanting help in

understanding procedure manuals for their labs. She connected their desire for more

guidance to the guidance that was occurring in the lab she worked in as they brought a

new technology and procedure into her lab.

Bethany acknowledged she had not previously considered students as wanting

more guidance on how to approach their disciplinary procedures. She went on to question

if providing students with short videos to watch prior to a lab on how to complete the

procedure would be beneficial. She noted how time was a constraining factor, as they

only had limited amounts of time with the students in both the classroom and the

laboratory. But she still wanted to encourage a discussion about procedures and provide

an opportunity for students to ask questions about a procedure. She noted, "if we invest

the time and then say, go home…watch the pre-lab video, read the procedure… I don't

know, that might inform the reading much better because they'd have a visual of it first."

As an experienced professor Bethany valued the input from her students and was already

considering how she could adapt her lessons to incorporate more guidance on disciplinary

reading. She saw the value in providing students with multiple avenues to learn as well,

such as reading a procedure, watching the procedure be performed, and then discussing

what they read. Participants from each level of disciplinary experience identified a

change in the guidance on how to transact with their MLS disciplinary procedures from a

disciplinary perspective as one way to provide apprenticeship for students.

Increasing Apprenticeship of College Students' MLS Disciplinary Reading

Transactions

Each participant also recognized their MLS disciplinary reading as essential to

understanding broader MLS concepts. Each group was able to collaboratively generate

ideas on how to apprentice college students to better navigate their disciplinary texts for

understanding.

College Students' Learning Experiences Throughout CRMA. Another

frequently cited area by the college students that could help in understanding disciplinary

literacy practices was in the transactions with disciplinary research articles. Each college

student noted they were expected to read and use various disciplinary articles but did not

have any direct instruction on how they should be reading them. Mary noted in her first

semester in the MLS program she had a research paper she had to complete. She felt she

was able to find research articles but once she got them, she had difficulty understanding

them and determining what parts were more relevant for her to focus on. She felt

modeling how to read a disciplinary research article at this point in the program would be

beneficial. Mary noted, "it will teach students how to read, so that way everything else

they find they kind of are able to get more out of and they have a better idea of what

they're looking for." Max agreed and felt it would help novices in the field better

understand what they are reading and what they should focus on while reading.

Ascending Professionals' Learning Experiences Throughout CRMA. All

three of the ascending professionals recognized how important disciplinary research

articles were to the discipline. They felt understanding them while in school had been

challenging and would have liked more guidance on what to look for and how to evaluate

a disciplinary research article. Lailah reflected at the start of this study she had

considered all research articles to be of a good quality, since they were published.

Through her participation and close interactions not only with the current college students

but also the faculty professionals, she felt her perspective changed. She noted this type of

discussion and specific guidance from someone with more disciplinary experience would

have been helpful as a student. Violet added she felt the way an expert would read an

article to be important to consider as well. She wanted to consider what areas did they

reread, why they felt one area of a text to be important over another, and then highlight to

students the reasoning behind their reading.

Faculty Professionals' Teaching and Learning Experiences Throughout

CRMA. As an expert faculty professional, Zoe had noticed students would frequently

seek out her assistance when they were writing up case study reports. During the senior

year the MLS students complete a semester of clinical internships at hospitals

laboratories where they rotate through the MLS sub-disciplines, chemistry, hematology,

etc. One of their assignments for each of their internships is to write up a summary of a

patient and discuss the pertinent lab values. Zoe noted she would frequently review drafts

for students and make suggestions of disciplinary articles for students to incorporate into

their papers. She would discuss the articles with students and found this to be an

enjoyable process. She liked being able to sit down with students and discuss disciplinary

research articles and provide suggestions for students on how to incorporate the articles

into their papers. She felt this type of guidance could be beneficial for students in helping

both their reading and writing and considered this one way she could work closely with students.

The faculty professionals regularly connected their disciplinary readings to how they could use them in the classroom. Following Mona's oral reading she noted "I think I would just take bits and pieces from the article and give it as extra material in a lecture, I don't think I would actually give them this to read." Mona considered the disciplinary text as relevant to what she was teaching, but more for the main points she could use to supplement her lecture. As noted previously, she screened the articles she used with students and had never given them an example of what she felt to be a "bad" article. She acknowledged how it would be helpful for students to have a more guided approach on how she, as an expert, navigated disciplinary research articles. Pointing out areas to focus on and how to assess quality of a disciplinary text.

Similarly, after Bethany read her think aloud chemistry text, she connected the text to how she would need to change her lecture. Bethany also considered how she would use the second text she read out loud differently. The authors of the second article she read highlighted how medication given to a patient erroneously affected the patient's lab results. She noted the mistakes the authors were highlighting to readers and it was more of a cautionary tale. She went on to note how using the article with students could help with their critical thinking, "I think it would point out to them that, yeah, you're sitting here in class – this really does happen!... And it could happen to somebody you know – I like that kind of reality check." This real-world incorporation of disciplinary texts into the curriculum was something Zoe further considered, "I wonder if there would be any room for something like a journal club…where you have them going through and

reading different articles every week or two weeks and discussing." Zoe was actively

considering how she could help facilitate a more guided approach for students on their

disciplinary readings. She listened to the students request for help with understanding

how to navigate disciplinary research articles specifically and considered ways she could

help them.

Throughout the CRMA sessions each participant came to recognize the

importance of apprenticeship into the disciplinary literacy practices which are central to a

MLS. They reflected on where they felt the MLS program did provide opportunities for

this apprenticeship to occur, as well as areas that could be strengthened through

enhancement of apprenticeship.

Summary of Findings

Throughout the study, faculty professionals, ascending professionals, and college

students were connecting their disciplinary readings to the MLS experience. They found

value in identifying how their past experiences helped to shape their disciplinary-specific

schemata. They recognized the relevance of their disciplinary texts to their individual

roles as an MLS, whether that be a student or a professional, and they considered how

this could change moving forward. These connections to practice provided a greater

understanding of how disciplinary literacy knowledge is constructed in this MLS

community.

As each participant considered how they came together as a community of

learners in their co-construction of disciplinary knowledge, they also reflected on their

individual roles in this MLS community. They became increasingly aware of the control

they had over their disciplinary reading process. Participants began to make explicit

connections between their efforts in meaning-making while reading and overall understanding of their disciplinary texts they read. Participants from each level of experience were able to identify opportunities for learning based upon their growing understanding about the reading process.

CRMA created opportunities for this MLS community to co-construct disciplinary literacy knowledge and fostered the atmosphere of a community of learners. This sense of community was created through positive encouragement and allowed participants to step outside their "comfort zones." Participants went on to view their engagement in CRMA as a positive learning environment and felt this form of apprenticeship into the disciplinary literacy practices of the MLS profession to be valuable. They considered how the MLS program currently used apprenticeship and discussed areas where they felt apprenticeship of disciplinary literacy practices could be expanded. Participants all recognized how their collaborations together fostered college students' disciplinary literacy knowledge. This study provided each participant the opportunity to discuss their disciplinary reading in ways they had never done previously. Their perspectives on disciplinary reading shifted and they began to consider the benefits of group learning to build a sense of community in the discipline. Each participant began to view themselves as an important piece in the co-construction of MLS disciplinary literacy knowledge.

CHAPTER 5

DISCUSSION

This qualitative case study explored how one MLS community actively transacted with their disciplinary readings to guide the teaching and learning of disciplinary reading. The Medical Laboratory Science community in this study was not an artificially created community. This MLS program had been an accredited program for 45 years and as such has a long-established history of educating college students and preparing them for their careers as MLSs. Additionally, many of the graduates of the program remain close in location to Mascar University and have close ties to the faculty. However, this MLS program is structured in a way that students move through their classes in a cohort model and generally do not interact with students from a different class or professional MLSs until their final semester during clinical rotations and after they graduate. This study brought together current college students, ascending MLS professionals (recent graduates), and faculty professionals who were experts in their given sub-disciplines (chemistry, microbiology, hematology, and transfusion medicine) to discuss their MLS disciplinary readings and provide insight into how they were creating meaning while engaged with their disciplinary texts.

Participants across all the three groups actively engaged with me and each other through their continual involvement in Miscue Analysis, Retrospective Miscue Analysis (RMA) and Collaborative Retrospective Miscue Analysis (CRMA). As all three groups of participants learned about miscues, everyone came to realize how Miscue Analysis can demonstrate the ways disciplinary readers are effectively and efficiently transacting with their disciplinary texts. Participants were able to learn more about themselves as

disciplinary readers and reflected on their socio-cognitive reading strategies as purposefully driven, meaning-making endeavors. Each participant considered their individual roles they played in group learning and discovered the impact they had on coming together as a community of learners. Participants saw themselves as disciplinary community members and by extension felt a deeper connection to the MLS profession.

Many of the tacit disciplinary-based strategic moves made by faculty professionals became explicit by having participants from various levels of experience come together to discuss their oral readings during CRMA sessions. This explicit awareness led the experts to consider how they take much of the disciplinary reading process for granted. Similarly, they realized how hard their students were working to make sense of many of their disciplinary texts. Through thoughtful reflections they considered how they could adapt their own teaching to better support students with their disciplinary reading. This explicit awareness also provided insight for novices on how to better approach their disciplinary readings with a disciplinary mindset. By coming together with a goal of learning from each other, this MLS community was able to co-construct disciplinary literacy knowledge through their participation in CRMA. They also were able to consider how to foster the development of college readers' MLS disciplinary literacy knowledge.

I focus in this chapter on further connections between the four themes described previously as they relate to building a disciplinary community that fosters the co-construction of disciplinary literacy knowledge, supporting lifelong disciplinary reading practices in MLS professionals, and creating meaningful learning opportunities in the

college disciplinary setting. I conclude with implications for teaching and

recommendations for future research.

Power of CRMA as a Literacy Event in Building a Community and Co-Constructing Disciplinary Literacy Knowledge

The power of CRMA in relation to student learning was apparent through this

study and its importance to fostering student growth is something to consider in

disciplinary reading assignments. Historically, CRMA has primarily focused on the K-12

setting (Costello, 1992; Seeger, 2009) but more recent studies have looked at CRMA

with college students where English was their second language (Wang & Zheng, 2017) or

college students with a documented reading disability (MacDonald, 2021). This study

was unique in that it looked at CRMA with college students in the disciplinary setting

where the readers identified English as their primary language and they did not have a

documented reading disability. This study adds to the body of knowledge on the ubiquity

of using CRMA with readers of all ages and abilities and the power CRMA holds as a

reflective instructional tool.

The CRMA sessions from this study had all participants actively learning from

each other. Each participant in this study became consciously aware of the power they

had over their own reading process through their participation in RMA and CRMA. They

came to recognize how the reading process occurred in all their readings from pleasure

reading to disciplinary reading. As they collaborated, they began to recognize how they

were not only learning more about themselves as readers, but also learning more about

what it means to be a Medical Laboratory Scientist. Their views on their approach to their

own reading process increased, especially for the college students and the ascending

professionals. The social nature of reading was made explicit for all readers and as they worked together their confidence grew. They recognized themselves as taking on the MLS disciplinary mindset and felt more connected to both their profession and each other.

Providing Opportunities to Develop Agency and Revalue Oneself as a Disciplinary Reader

This study suggests the need for faculty professionals in higher education to provide opportunities for students to develop a sense of agency in their disciplinary readings. They can give students more chances to authentically engage with disciplinary texts used in the professional setting so college students are better able to make connections between what they are learning and how they will be using their readings upon graduation. Students can then be provided a pathway to feeling more connected to the discipline they are entering by taking more ownership over their disciplinary learning and revalue themselves as strategic disciplinary readers.

Moje (2015) considers disciplinary literacy events as based in the social settings in which they occur. The CRMA sessions in this study were not simply sessions to discuss skills-based reading practices, but rather were embedded in the culture of the MLS discipline, and miscues were considered and valued for their relation to the discipline. This study demonstrated the situated literacies that were occurring in this MLS community and allowed the participants the opportunity to consider the MLS disciplinary literacy habits of mind (Fang & Coatoam, 2013). This indicates the need for faculty professionals to establish a sense of community in the college discipline setting to build student confidence and enculturation into the disciplinary community. This supports the

need to foreground the disciplinary literacy habits of mind when students are engaged in group learning.

Incorporating CRMA to Build Confidence and Reader Identity

Participants in this study became more confident in their own abilities as strategic readers through participation in CRMA. Self-perceptions on reading ability positively increased. Some of the participants began the study with a pre-conceived notion about their reading ability and identified as poor or below average readers. CRMA created a safe space for students to reimagine their reading identity. Readers came away with a more positive perspective about themselves as readers. This positive change in reader identity is consistent with other scholarly works (Gilles, Osborne, & Johnson, 2020). Through participation, college students and ascending professionals began to revalue themselves as readers and began to form a new sense of reader identity. This suggests the need for faculty professionals to provide opportunities at the college level to build reader confidence and ability. This study demonstrated the effective usage of CRMA as a way to build reader confidence as they discussed textual features they found challenging.

Empowering Disciplinary Readers to Take Risks

Participants in this study reflected on their own meaning making processes as well as those used by other readers in their Teams during multiple CRMA sessions. They began to realize they were all using multiple socio-cognitive reading strategies to make sense of complex disciplinary texts. As they grew more confident in their discussions of disciplinary literacy practices, they also were more willing to take risks. By the second oral reading sample completed by the college students, they became less concerned with how their oral reading would sound when read in front of others and more concerned

with their own efforts toward meaning making. This is consistent with other scholars'

findings that after multiple readings the performance nature of the reading diminishes and

more patterns are able to emerge in their readings (Liwanag et al., 2020). This suggests

the need for faculty professionals to provide college students the opportunity to verbalize

disciplinary specific terminologies from their readings. This practice would help college

students gain confidence in their understanding of disciplinary concepts and their ability

to use these terminologies in the workplace upon graduation.

　　　　All participants became more comfortable discussing their own readings, and

even highlighted where they had "disruptive" miscues and loss of meaning over high

quality miscues (Flurkey, 2020, p. 150). Each time they considered their miscues, both

high quality and disruptive ones, they approached them from a disciplinary mindset. This

allowed a greater appreciation of what it means to read like an MLS and increased the

sense of community amongst participants. This study demonstrates the need for faculty

professionals to regularly engage students with various authentic disciplinary texts and

provide them opportunities to discuss disciplinary readings with their disciplinary

community. This can further support college students' development of reader identity as

they become more confident working with their peers and their professors to construct

meaning from their disciplinary texts. Faculty professionals need to be allowed to see

where students are struggling with their disciplinary texts to better support student

learning. College students can also benefit by becoming aware they are not alone in their

challenges with disciplinary texts and can further support each other.

Fostering Apprenticeship into Disciplinary Literacy Practices

This study revealed the power of CRMA to foster a sense of community and make the implicit disciplinary literacy practices become explicit for this MLS community. CRMA's effectiveness as a learning tool has been demonstrated at all levels of instruction, elementary schooling through higher education (Costello, 1992; MacDonald, 2021; Seeger, 2009; Wang & Zheng, 2017). Utilizing CRMA in the disciplines in the college setting can be a way to apprentice students into the unique disciplinary literacy practices of each discipline while creating a sense of community and belonging. Another distinct feature about CRMA is that it allows for the co-construction of disciplinary literacy practices amongst participants. More knowledgeable experts can help guide and mediate learning (Vygotsky, 1978), while at the same time being seen as a peer who is learning alongside the student (Flurkey, 2020). This suggests the power of CRMA as an instructional tool to guide students into the ways of the discipline. While much of the research on disciplinary literacy has remained conceptual (Fang & Coatoam, 2013), this study brings forth empirical evidence of how disciplinary literacy practices are enacted in the MLS discipline.

Using CRMA to Co-Construct Knowledge Across the Continuum of College Student to Professional

This study is innovative in that it brought together current students with ascending professionals and faculty experts in the MLS profession. I felt having recent graduates, the ascending professionals, from the MLS program under study to be important. They were close in age and experience to the current college students, yet had started their careers and had valuable experience they could share. They also could more effectively

provide feedback on ways to better support current students as they could relate what

they had learned while as a student in the MLS program to what they knew and used –

they could see where the gaps were in teaching disciplinary literacy practices. Their

ability to facilitate the co-construction of disciplinary literacy knowledge was important

due to their diverse perspectives they brought to the study.

There is a void in the current literature looking at the disciplinary literacy

practices of college graduates' enactment of literacy practices in the workplace, not tied

to the educational setting. As evidenced throughout this study, the ascending

professionals were an important bridge between the college students and the expert

faculty professionals. Through their insightful contributions, they noted increased self-

efficacy of their own disciplinary literacy practices and felt a renewed sense of pride in

their role in the discipline. They looked forward to future opportunities where they could

mentor less experienced MLSs or MLS students on disciplinary literacy practices. They

had a renewed appreciation of their disciplinary readings and saw their "reading as a

meaningful lifelong process (Gilles, Johnson, & Osborne, 2020, p. 93). CRMA provided

them a new way of thinking about their reading, not as a solitary event, but a dynamic

social interaction that encouraged a rich discussion into the disciplinary literacy practices

of Medical Laboratory Science.

This study suggests faculty professionals should bring ascending professionals

into the MLS classroom to help apprentice college students into disciplinary literacy

practices more frequently. This study demonstrated the effective usage of an online

platform to engage readers outside of the classroom. Findings of this study can also be

used to better inform faculty professionals on how to continue to support recent graduates as they transition into the professional workplace.

CRMA Makes Implicit Disciplinary Literacy Practices Explicit to Support College Students' Development and Co-Construction of Disciplinary Literacy Knowledge

A primary focus of this study was discovering how to better support college students in their disciplinary reading. Key discoveries from this study included finding ways to better support students in their disciplinary readings, outlining what in their disciplinary reading needed to be made explicit. Multimodality of MLS disciplinary texts was one area of need for this MLS program. Making the inherent multimodal nature of MLS disciplinary texts explicit to students and guiding them on the integration of multimodal features with text-based reading is crucial for student success in the Medical Laboratory Science discipline.

Camillo's work (2019) identified the ubiquitous nature of multimodal features for MLS disciplinary reading. College students in this study largely did not prioritize the multimodal features in their disciplinary readings, despite acknowledging pictures were the first thing they looked at when they began a disciplinary reading. Many students at the beginning of this study viewed the multimodal features as unnecessary, which stood in stark contrast to the professionals in the study. After multiple CRMA sessions, college students' perspectives on the integration of multimodal features shifted to be more in line with faculty professionals. The faculty professionals in this study prioritized the multimodal features of their disciplinary texts and regularly integrated them during their reading to increase their understanding. The faculty professionals recognized the various multimodal features as not only a common feature of disciplinary readings but saw them

as non-repetitive information (Lemke, 1998). This supports the need for faculty

professionals to approach disciplinary reading as embedded within the literacy practices

(Moje, 2015) used by members of the disciplinary community. College students can learn

to navigate disciplinary readings more effectively by making faculty professionals

disciplinary reading practices explicit and discussing their strategic reading process.

Importance of Appropriate Disciplinary Texts to Support Student Learning

College students and professionals alike noted how the placement of the

multimodal features could either support or hinder their integration while reading and

subsequent understanding. Participants in this study felt images or tables used in their

disciplinary readings needed to be readily accessible, consistent with other scholars (East,

in press; Kress & van Leeuwen, 2006). This brings into question how the layout of not

only disciplinary textbooks, but other disciplinary readings are structured as contributary

to understanding. These participants all noted how they regularly used the internet for

many of their disciplinary readings and additionally many students noted their usage of e-

textbooks. All participants acknowledged they preferred print-based texts to online texts,

and I used printed texts for this study. Often, online text is displayed differently than print

text and links to multimodal features, such as an image or table, are provided. The reader

must click the link and when the multimodal feature is displayed, the text may no longer

be present. This layout prevents the effective integration of multimodal features with text

and also may be a reason some readers fail to look at the multimodal features. As many

universities are moving toward Open Access and using E-textbooks, this has to be a

consideration for educators as well.

This study informs faculty professionals on the importance of appropriately selecting disciplinary readings to support student learning. College students are considered novices in their respective disciplines, it is in the college setting that they are learning the literacy practices specific to the discipline. College students need their texts to support them in their understanding of complex disciplinary concepts. Online reading requires additional work from a reader to strategically manage the interconnectedness of text, images, and links (Cho & Afflerbach, 2017). College readers need to be able to conceptualize the general layout of a reading in order to cohesively integrate each piece and monitor their understanding. This study helps to inform our understanding on how college students navigate their disciplinary texts.

Faculty Professionals as Instrumental in the Co-Construction of Disciplinary Literacy Using CRMA

The faculty professionals in this study had a well-established relationship with each of the college students and ascending professionals. They were able to build upon this relationship and increase the comfort and confidence of all the participants. Similar to the teachers in Gilles, Johnson, and Osborn's (2020) CRMA study, the professors in this study used "positive, respectful language" with each participant (p. 92). This created an environment that encouraged risk taking and collaborative conversation amongst each Team. Faculty professionals' role in this study was as a more knowledgeable peer, and they helped to facilitate each CRMA session. They helped to mediate student awareness of the disciplinary reading process and helped foster disciplinary literacy gains in each student (Vygotsky, 1978). Through CRMA, faculty professionals were also able to more fully appreciate where students were struggling or challenged with their disciplinary

readings. Thus, a more targeted clarification of MLS disciplinary readings could be developed (Y. Goodman et al., 2005). Miscue Analysis was not seen as just a research tool but also an instructional tool. This study demonstrated the value which developed for faculty professionals of Miscue Analysis as an instructional tool to help inform their curricular decisions. As a faculty professional myself, I prefer to highlight student strengths when developing curriculum for my classroom. CRMA can be used in the disciplinary setting to work with students to foster their disciplinary literacy knowledge from an asset-based perspective.

The faculty experts in this study were not previously aware of certain gaps in student understanding coming into the discipline, for example, in this study lack of knowledge on how to read roman numerals. An awareness of this deficit, made apparent through CRMA, provided the faculty a simple means of alleviating this disciplinary reading challenge. This suggests how CRMA can help inform faculty professionals of areas where student understanding is incomplete and provide a means to enhance understanding. By having a collaborative conversation about disciplinary literacy, teachers can become more sensitive to student struggles and begin their instruction at a level appropriate and individualized to students as a way to foster increased growth in disciplinary literacy knowledge.

This study also provided faculty professionals with empirical evidence as to how hard students had to work to construct meaning with some of their disciplinary texts. College students wanted to enhance their feeling of belonging to their disciplinary community but were challenged by the disciplinary texts they encountered. College students noted they would frequently use the internet for fast clarification on unclear

disciplinary concepts, not necessarily successfully. This study suggests the need for

faculty professionals to consider ways to help college students and encourage them to

seek out clarification from their professors, without having them solely turn toward the

internet. This study highlights the benefits of using group learning to provide clarity of

challenging disciplinary concepts.

CRMA also afforded the faculty the opportunity to reflect on the ease with which

they constructed meaning from their disciplinary readings. By having this awareness,

they became more sensitive to how hard students had to work to understand the

disciplinary texts to the same degree they did. This suggests the need for faculty

professionals to more regularly demonstrate how they use their disciplinary funds of

knowledge (Moll et al., 1992) to approach their disciplinary texts.

Opportunities to Increase Faculty Professionals' Awareness of Miscue Analysis

This study then calls into question how can the MLS profession support

laboratory educators. The ASCLS does provide continuing education opportunities for

MLSs and specifically holds a yearly conference for laboratory educators to meet and

share curriculum ideas. This avenue would be an appropriate professional development

opportunity for laboratory educators to learn about Miscue Analysis and how it could be

utilized in their curriculums. This study demonstrates the benefit of having faculty

professionals engage their college students with CRMA using disciplinary texts. This

would be a powerful avenue to reach other MLS educators. Coming together as a

community of disciplinary educators would allow for more ideas incorporating Miscue

Analysis as a reflective instructional tool in the discipline to be brought to light.

The three faculty professionals in this study had not previously used Miscue Analysis in their classrooms. They each were able to see how using Miscue Analysis could promote student understanding of disciplinary readings. Providing students with both well-written disciplinary texts as well as poorly written texts to compare could help students become more insightful into approaching disciplinary texts from a disciplinary mindset. Reading as an MLS is also tied to the professional development of practicing MLSs (Camillo, 2019). To maintain certification as a MLS, each professional needs to complete continuing education requirements every three years. A common way to obtain the necessary credits is by reading disciplinary articles and answering questions about the article. Ensuring students are adequately prepared to meet the demands of the literacy practices for the discipline after graduation is an important factor for educators to consider. Utilizing CRMA in the MLS disciplinary classroom would show educators and research-practitioners where there are needs for further training and support of the disciplinary literacy practices.

Implications of the Study

This study revealed the positive effects group learning had on this MLS community. All the college students in this study felt supported by the members across all three groups from the CRMA Teams they were on. This study was able to demonstrate the social constructivist nature of learning. Educators need to provide opportunities for students to work collaboratively to share ideas and understanding as often as possible. This can be accomplished when faculty provide learning opportunities for students to engage in group learning, such as CRMA, where students are allowed to learn with and from each other. College students in a discipline are learning how to acclimate to their

discipline, and are looking to become a member of the disciplinary community. Through

collaboration, students can learn how to navigate group dynamics, they are afforded

diverse perspectives, and if appropriately supported have an increased sense of

belonging. Faculty professionals can foster in college students a sense of belonging in the

discipline by embedding the co-construction of disciplinary literacy knowledge within the

constructs of the disciplinary community. Faculty professionals could provide remote or

online learning opportunities to enable ascending professionals at a distance to be more

involved in fostering disciplinary community development and learning opportunities in

classroom settings. These attributes can benefit students as they transition from school

into the workplace.

The Miscue Analysis, RMA, and CRMA used in this study can help to inform

curricular decisions for this individual MLS program. The professors in this study wanted

to help their students understand their disciplinary readings. A goal of the faculty

professionals was to better understand when they should intervene during a student

reading. They initially believed if a student miscued while reading it meant they were

understanding their text incorrectly. Through their participation in CRMA they came to

realize how high-quality miscues indicated strengths for the readers, and it is only low-

quality miscues that need correcting. This was an important discovery the faculty had and

has implications for their teaching practice. Iddings (2020) recommends teachers let

student meaning making occur naturally and to avoid intervening too soon. This is an

important concept for teachers to recognize and to follow. If they interrupt a student too

soon in their reading, the student may lose the ability to use their various disciplinary

socio-cognitive reading strategies and language cuing systems to construct meaning. By

allowing a student to utilize various reading strategies to work through their disciplinary

reading, they gain confidence in their own ability. Teachers can encourage college

students to take risks with their disciplinary readings and can more accurately determine

where complex disciplinary concepts may challenge a student. I propose faculty

professionals incorporate CRMA into their disciplinary courses as a way for students to

explore their disciplinary reading identity, revalue themselves as strategic disciplinary

readers, and build confidence in themselves as disciplinary readers.

This study also affirms previous research (Gilles, Johnson, & Osborn 2020;

Jurich, 2020) that students need more opportunities to read their disciplinary texts and

engage in thoughtful discussions about their texts. Faculty professionals can also use

Miscue Analysis with disciplinary texts they feel are poorly written to demonstrate how

they critically analyze texts as an example for students as well. These can be used to

highlight to college students the active role the reader takes in constructing meaning of

disciplinary texts. Faculty professionals could purposefully incorporate instruction on

disciplinary reading practices for college students. They could implement guided reading

using various multimodal disciplinary texts highlighting their own integration of

multimodal features for understanding

A possible reading assignment for an MLS classroom would include various

disciplinary readings from one topic. For an MLS, the topic could be a new laboratory

test or disease treatment. Students could be assigned to different groups to read a

disciplinary text on the topic, one group could read a research article, another a case

study, another review lab results from a patient, another could even read a popular news

article on the topic. Each group could complete Miscue Analysis on their respective texts.

Groups could come together and then discuss the various formats disciplinary readings can occur. Discussions can include how they worked to understand their readings, where meaning may have broken down, and how they incorporated their growing disciplinary knowledge to better understand the disciplinary texts. This type of assignment could increase student awareness of the types of disciplinary readings that are available and better equip them to learn how to integrate multiple readings and sources for understanding.

Recommendations for Future Research

The faculty professionals who participated in this research study were fascinated by EMMA and wanted to see their own eye movements while reading disciplinary texts. They agreed that EMMA adds to our current understanding about the reading process (Brown et al., 2012; Liwanag et al., 2020). These faculty professionals considered how they currently approached their disciplinary texts through this study and recognized much of what they did while reading was tacitly done. They additionally wondered if they were making other strategic moves in understanding their texts that would not be revealed unless their eye movements were recorded. They felt this could show students in a more in-depth manner how experts were transacting with their disciplinary texts. Future studies could include eye movement miscue analysis of expert MLSs reading various disciplinary texts. Texts could include disciplinary textbooks, case studies, research articles, and even procedure manuals, to better inform our understanding on disciplinary approaches across the spectrum of disciplinary readings. Future eye movement tracking studies across more disciplines could also inform our understanding surrounding the tacit reading behaviors across the disciplines.

Previous CRMA studies have explored in person CRMA sessions, with all participants gathered together in the same room (Costello, 1992; MacDonald, 2021; Seeger, 2009; Wang & Zheng, 2017). This study brought together participants from distant locations and was completed in an online format. While using an internet-based meeting site indeed produced technical challenges inherent to online use, not all aspects of using an online platform was negative. This study used Zoom to hold each CRMA session with both Teams. These meetings would not have been possible without Zoom. Each participant had varied work and school schedules and were located in different cities more than 100 miles apart, Zoom enabled more flexible meeting times. The usage of Zoom, or other online-based meeting platform, to hold CRMA sessions should be further investigated. With the COVID-19 pandemic, many schools transitioned to solely online learning. Teachers from every level (K-12 and higher ed) had to reimagine how they were supporting positive learning environments for students. CRMA is an effective and efficient instructional tool that can be used to help students (Costello, 1992). Studies into how to effectively bring CRMA into the online classroom should be done as a way to increase opportunities for collaboration.

This study examined how one MLS program utilized Miscue Analysis. A potential for future studies would be to investigate Miscue Analysis in other undergraduate MLS programs with diverse communities, including members across all ages, races, and levels of experience. Future studies could investigate how community members from other MLS programs are transacting with their disciplinary readings using Miscue Analysis in both the individual (RMA) and group (CRMA) settings, and if available, incorporating Eye Movement and Miscue Analysis (EMMA) as well. These

future studies could provide further insight and more generalizable findings on how MLSs co-construct disciplinary literacy knowledge, not just from this one MLS program. This would enable comparisons across programs and better inform curricular decisions for the profession at large.

Similarly, future investigations could look at the incorporation of MA into the MLS classroom. Rather than studying an entire MLS program using MA, future studies could look more specifically at one sub-discipline, for example a hematology classroom. College students in this study were extremely receptive to Miscue Analysis, enjoyed the process, and demonstrated increase confidence in their individual disciplinary reading process. Collaborative Retrospective Miscue Analysis could be incorporated into the curriculum of an MLS course and studied to see how students co-construct their disciplinary literacy knowledge.

Finally, a practical implication from this particular study would be to look at the suggestions made by students and ascending professionals on increasing apprenticeship opportunities with disciplinary readings and navigating procedure manuals in this MLS program. This MLS program participates in a self-study program and undergoes site visits as part of the accreditation process every 10 years. Part of this process includes recognizing performance improvement projects and studying them for specific outcomes. Pre and post studies could be done evaluating the incorporation of recognized areas of need into this MLS curriculum and the effectiveness of increased apprenticeship of disciplinary literacy practices.

Final Thoughts

I began this study already having a close relationship with all the participants. I was a former student myself of two of the faculty professionals, I had taught all the ascending professionals, and was a teacher to all the college students. As such, I was a faculty professional myself. I was able to interact with the college students daily and was able to strengthen my relationship with these students through our connections and relationships we fostered during our CRMA sessions. I thus approached this study as a teacher-researcher. My own epistemological beliefs were foundational for how I view and approach the construction of knowledge. I believe the learning environment, in conjunction with the teacher and the students, brings about a shared understanding of the disciplinary texts read. This environment enables the co-construction of disciplinary knowledge. My primary goal in designing this study was to find ways to help my own MLS college students efficiently and effectively read their disciplinary texts for understanding. I have a deeper appreciation of how Miscue Analysis and Collaborative Retrospective Miscue Analysis can support adult learners in their disciplinary reading through my own participation in this study.

This study helped inform curriculum decisions within the MLS program under study. Faculty professionals in this study were able to reflect on their current curriculum and consider areas where students were challenged with their disciplinary readings and through collaborative conversations were able to identify possible areas for change. This study demonstrated how important it is to apprentice novices into the disciplinary literacy practices of the profession that are often tacitly done by experts in the field. It is important for educators to make explicit their disciplinary literacy practices to foster

students' ability to take on the mindset of the discipline. Apparent in this study was each

readers' unique strengths as a disciplinary reader. Educators should avoid approaching

their students from a deficit perspective, focusing on inaccuracies, but rather approach

their students from an asset perspective to help foster individual growth. CRMA provides

educators the ability to assess the individual needs of students while also allowing

apprenticeship into the literacy practices of a discipline to better support student growth.

At the same time, CRMA informs our understanding of how members of a

disciplinary community come together to co-construct knowledge. This study

demonstrated the positive effects of group learning in a disciplinary college setting and

can better inform the teaching and learning of disciplinary literacy practices. A stronger

sense of community within the discipline was created and this could provide more

thoughtful and engaged professionals. This study provides empirical evidence for Miscue

Analysis as a powerful research and teaching tool regardless of the discipline in which it

is used. This study further informs our understanding on literacy research using Miscue

Analysis with adult learners while also expanding our current understanding of

disciplinary literacy research in adult learners.

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APPENDICES

APPENDIX A: BRI Semi-Structured Interview Questions

1. When you are reading and you come to something that gives you trouble, what do you do? Do you ever do anything else?
2. Who is a good reader you know?
3. What makes _____ a good reader?
4. Do you think _____ ever comes to something that gives him/her trouble when he/she is reading?
5. When _____ does come to something that gives him/her trouble, what do you think he/she does about it?
6. How would you help someone who was having difficulty reading?
7. What would a teacher do to help that person?
8. How did you learn to read?
9. Is there anything you would like to change about your reading?
10. Describe yourself as a reader. What kind of reader are you?
11. What do you read routinely, like every day or every week?
12. What do you like most of all to read?
13. Can you remember any special book or the most memorable thing you have ever read?
14. What is the most difficult thing you have to read?

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APPENDIX B: Semi-Structured Think Aloud

and Oral Readings Follow-Up Interview

Thank you for your time so far. I have just a few more questions based on the two texts you have just read out loud, both from the think aloud and the uninterrupted oral reading.

College Students:

- How do you feel these texts are important for the MLS discipline?
- How would you define being literate in the MLS discipline?
- How would you characterize someone who reads proficiently in the discipline?
    - o Do you feel proficient in your reading disciplinary texts? (Explain if needed, in what ways feel proficient, when they felt they became proficient)
- How has studying in MLS effected your reading?
- How has your reading changed or developed since being in the MLS program?
- How do you see yourself using these texts (for class, for work, etc.)?
- In what ways has reading these texts contributed to your understanding of the MLS discipline?
- How do you felt you used your MLS disciplinary knowledge to understand the text?
- Is there anything you would like to know more about after reading these texts?
- Are there any things that you would do differently in your reading if I wasn't here?
    - o What are they?
- What kind of direct reading instruction have you had in college?
    - o Have you had any type of reading instruction in your MLS program?
    - o How does in-class instruction and experiences relate to your reading disciplinary texts?
- What do you feel was the best part about your reading today?
- What do you feel was the most challenging part about your reading today?
- What would you think would be helpful as a student to know about reading in the discipline?

Ascending Professionals:

- How do you feel these texts are important for the MLS discipline?
- How would you define being a proficient reader in the MLS discipline?
- How would you characterize someone who reads proficiently in the discipline?
    - o Do you feel proficient in your reading disciplinary texts? (Explain if needed, in what ways feel proficient, when they felt they became proficient)

- How has your reading changed or developed since being an MLS?
- How do you see yourself using these texts (for work, for any future class/education, etc.)?
- In what ways has reading these texts contributed to your understanding of the MLS discipline?
- How do you felt you used your MLS disciplinary knowledge to understand the texts?
- Is there anything you would like to know more about after reading these texts?
- Are there any things that you would do differently in your reading if I wasn't here?
  - What are they?
- What kind of direct reading instruction if any can you recall as an MLS?
  - How did you learn to read based off disciplinary standards?
- How do you support (or scaffold) any MLS students you see in the lab or come in contact with (if they do) in their disciplinary reading? (or support in their navigating disciplinary texts)
- What do you feel was the best part about your reading today?
- What do you feel was the most challenging part about your reading today?
  - What do you think would have been most challenging for a student?
- What do you think would be helpful for a student to know about reading in the discipline?

Faculty Professionals:

- How do you feel these texts are important for the MLS discipline?
- How would you define being a proficient reader in the MLS discipline?
- How would you characterize someone who reads proficiently in the discipline?
  - Do you feel proficient in your reading disciplinary texts? (Explain if needed, in what ways feel proficient, when they felt they became proficient)
- How has your reading changed or developed since being an MLS?
- How do you see yourself using these texts (for class, for work, etc.)?
- In what ways has reading these texts contributed to your understanding of the MLS discipline?
- How do you felt you used your MLS disciplinary knowledge to understand the texts?
- Is there anything you would like to know more about after reading these texts?
- Are there any things that you would do differently in your reading if I wasn't here?
  - What are they?
- What kind of direct reading instruction if any can you recall as an MLS?
  - How did you learn to read based off disciplinary standards?
  - What ways do you include MLS disciplinary specific reading instruction in your class?

- How do you choose MLS texts to use with your students?
- How do you support MLS students in their disciplinary reading?
- How do you currently use disciplinary reading in the classroom?
    - How do you envision using reading in the classroom- any direct instruction? If so, in what ways (in or out of the classroom)?

- Also you might want ask they how they scaffold their students meaning making process when they navigate disciplinary texts.

    -
- What do you feel was the best part about your reading today?
- What do you feel was the most challenging part about your reading today?
    - What do you think would have been most challenging for a student?
    - Also, you might want to ask a follow up questions to see how they meet their needs to help them overcome their challenges.

APPENDIX C: RMA Session Organizer

For each miscue discussed, first I showed the text to the reader for them to read. I asked if they remember what happened when they read it initially. I then played the sentence back for them to hear and asked "Did you notice anything?" I followed with:

1. Does the miscue make sense?
2a. Was the miscue corrected?
2b. Should it have been?

Depending on how they are answered, questions 1 and 2 initiate discussions about the non-necessity of self-correcting high quality miscues (1-Yes, 2a-No, 2b-No). These questions also emphasize the importance of self-correcting when meaning is lost (1-No, 2a-Yes, 2b-Yes). If the answer to questions 1 and 2a is "No," then we ask question that focus on other cueing systems (graphic and sound similarity) the reader may have used in making the miscue:

3. Does the miscue look like what was on the page?
4. Does the miscue sound like what was on the page?

Questions 5 and 6 raise thinking about the strategies of selecting and predicting to a conscious level:

5. Why do you think you made this miscue?
6. Did that miscue affect your understanding of the text?

Additional questions dependent upon individual miscues made.

Reader: _____

Date: _____

Text: _____

Miscue No.	Time on Recording	Line Number	Miscue

Notes:

Goodman, Y., Martens, P., & Flurkey, A. (2014). *The essential RMA: A window into readers' thinking*. Richard C. Owen Publishers, Inc.

APPENDIX D: CRMA Instructional Guide

- Discussion on the reading process and the concept of miscues not mistakes.

- Review of general strategies readers use (skipping, asking others, looking up

  terms or phrases, substitution, stopping the reading, etc.).

- Discuss the language cueing systems: Semantic, Syntactic, Graphophonic, and

  Pragmatic.

    o Discuss sentences that show strength and weakness of the language cueing
      systems.
    o Further discuss sampling, selecting, prediction, confirming/disconfirming,
      self-correction strategies (Y. Goodman et al., 2005).
- Practice coding sentences, asking (Y. Goodman et al., 2014):

    o Does the miscue make sense?_____
    o Was the miscue corrected, should it have been?_____
    o Did what the reader said mean the same thing as what was in the
      text?_____
    o Did what the reader said sound like language?_____
    o Did what the reader said look like what was in the text?_____
- Practice using the CRMA session organizer (see Appendix E).

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APPENDIX E: CRMA Session Organizer

Text used: _____

Miscue: _____

1. Does the miscue make sense? _____
2. In what ways does it make sense? In what way doesn't it make sense?
3. Did the reader change it after they made the miscue? Write the change made.
4. Do you think it should have been changed? Why?
5. How did the miscue help or not help understanding of the text?
6. Why do you think the miscue was made?
7. Think of as many possible reasons for this miscue as you can. (Discuss). What do you think about these reasons?

Costello, S. (1992). *Collaborative retrospective miscue analysis with middle school students* [dissertation, The University of Arizona]. Tucson, Arizona.

APPENDIX F: CRMA Focal Group Interview Questions

1. What did you mean when you said_____?
    a. Why do you feel you are perceiving it this way?
2. How do you feel about talking about your own miscues with me after reading?
    a. With your peers? With students?
3. How do you feel miscue analysis can apply to the discipline?
4. In what ways are each of you reconsidering your reading skills/habits?
5. In what ways are you thinking about reliability of what you read?
6. Why did you feel this was an important miscue_____?
    a. How are these examples of larger ideas in the discipline?
7. I feel your interpretation of the reading process meant____, what am I missing?
    a. What areas about the reading process do you find confusing as a college student?
    b. What aspects about the disciplinary reading process should be taught or modeled for college students?
8. How are you thinking about a text "looking right", "sounding right", and "making sense"?
9. What are some ways of reading like an MLS/What does it mean to read like a MLS?
    a. Why are these reading processes important to a MLS?
10. What do you think about the RMA process in general?
    a. Tell me about your experience.
11. What do you think about the CRMA process?
    a. Tell me about your experience.
        i. Did you enjoy your experience?
12. Did you prefer RMA or CRMA? Why?
13. How do you think CRMA can be used in the MLS discipline?
14. Faculty Professionals: I had asked each of you at the beginning how you thought CRMA may be helpful for you in thinking about your teaching in the discipline. Do you feel you accomplished this or have a greater awareness or insight into your students' reading?
15. I want to revisit some terms/concepts from previous conversations with each group:
    a. How would you judge the quality of the source for reliability and usefulness?
    b. How do you consider what you can learn from a text?
    c. What are factors you consider for relevance to current practice?
    d. What does proficient reading look like in MLS?
    e. What are authentic reading practices for a MLS?
    f. How are you thinking about multimodality in terms of reading in MLS?
16. How would you consider the texts we read to be disciplinary?
17. College Students: How have your MLS teachers helped support your disciplinary reading?
18. Ascending Professionals: How have your MLS teachers helped support your disciplinary reading?

19. Faculty Professionals: How are you supporting students reading development?
20. College Students/ Ascending Professionals: In what ways do you feel your MLS disciplinary teachers have tried to relieve you of the burden of reading difficult material?
21. Ascending Professionals: How have others you work with supported your reading?
22. Faculty Professionals: In what ways do you feel you have tried to relieve students of the burden of reading difficult material?
23. College Students: How have you thought about how your reading in the discipline will look upon graduation?
24. What moment of this study stood out to you the most and why?
25. How will you use what you have learned moving forward?
26. What do you feel you have learned by participating in this study?
27. How was it helpful to have (faculty professionals/ascending professionals/college students) participating in this study?
28. What do you feel was the most important thing you learned?
29. Is there anything else you think I should know?

APPENDIX G: RMI Procedure III Reader Profile Form

Appendix G: Blank Reader Profile

READING MISCUE INVENTORY
Procedure III—Reader Profile

Reader _____ Date_____

Selection read _____

Number of sentences coded _____

INFORMATION FROM TYPESCRIPT
    Comprehending in Process (Sentence Codings)
        _____   _____ % YYN
        _____   _____ % YYP
        _____   _____ % YYY
        _____   _____ % YN–
        _____   _____ % NN–

    Syntactic Acceptability
        _____   _____ % Acceptable
        _____   _____ % Unacceptable

    Semantic Acceptability
        _____   _____ % Acceptable
        _____   _____ % Unacceptable

    Meaning Change
        _____   _____ % No Change (N)
        _____   _____ % Partial Change (P)
        _____   _____ % Change (Y and Dash)

INFORMATION FROM RETELLING GUIDE
    Comprehension   _____ %

INFORMATION FROM MISCUE TALLY FORM
    Total Number of miscues tallied _____
        Corrections
        _____   _____ % Self-Corrected
        _____   _____ % Uncorrected, No Meaning Change
        _____   _____ % Uncorrected, Partial Meaning Change
        _____   _____ % Uncorrected, With Meaning Change

    Total Number of miscues coded for graphic similarity _____
        Graphic Similarity
        _____   _____ % High
        _____   _____ % Some
        _____   _____ % None

COMMENTS

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    Heinemann

APPENDIX H: Explanation of Miscue Markings

Substitutions
Substitutions are shown by writing the miscue directly above the word or phrase. Read as *He hated to get Marcel's white hairs on his beautiful new shirt.*

He hated to get Marcel's white hairs on his

shirt
beautiful new suit.

Omission
Omissions are marked by circling the omitted language structures. Read as *"I can do that," replied the husband.*

"I can do (all) that," replied the husband.

Insertions
Insertions are shown by marking a proofreader's caret at the point of insertion and writing the inserted word or phrase where it occurs in the text. Read as *"Now I've got some more work to do," said the man.*

some
"Now I've got ∧ more work to do," said the man.

Regressing and Abandoning a Correct Form
Abandonments are marked by drawing a line from right to left at the point at which the reader went back to repeat but abandoned the expected text. An (AC) is used to indicate this type of regression. In this example, the reader first reads *head against the wall*, then rejects this possibility and produces the more sensible *hand against the wall*. Read as *"How many times did I hit my head against the wall—hand against the wall?" she asked.*

(AC) *hand*
"How many times did I hit my head against the

wall?" she asked.

Regressions or Repetitions
Linguistic structures that are reread are underlined to explicitly show how much the reader chose to reread. Regressions are marked by drawing a line from right to left to the point at which the reader went back to repeat. An (R) designates simple repetitions. Multiple repetitions, words or phrases that are repeated more than once, are underlined each time they occur. Read as *Why don't you—Why don't you do my work some day?* and *All at—All at—All at once I was covered with red paint.*

(R)
Why don't you do my work some day?

(R)
All at once I was covered with red paint.

Regressing and Correcting the Miscue (self-corrections)
Self-corrections are marked by drawing a line from right to left to the point at which the reader went back to repeat in order to correct the miscue. A (c) indicates a correction.

The markings in this example show that the reader substitutes *flash* for the words *few minutes*. She then regresses and corrects the miscue: *I'll light a fire in the fireplace and the porridge will be ready in a flash—a few minutes.*

I'll light a fire in the fireplace and the porridge will

(c) *flash*
be ready in a few minutes.

Substitutions Often Called Reversals
An editor's transposition symbol shows which words have been reversed. Read as *I sat down looking at Andrew.* and *Something was wrong with Papa.*

I sat looking down at Andrew.

Was something wrong with Papa?

Regressing and Unsuccessfully Attempting to Correct
Unsuccessful attempts to correct are marked by drawing a line from right to left to the point at which the reader began to repeat in an attempt to correct. A (UC) is used to designate this type of regression.

In this example, the reader says *river washed* twice and this is marked as (UC), an unsuccessful attempt at correction. Read as *And this he did with such might that soon the river washed—river washed over its banks,...*

And this he did with such might that soon the

(UC) washed
river rushed over its banks,...

Nonword Substitutions
A dollar sign ($) indicates that a reader has produced a miscue that is not recognizable as a word in the reader's language. Retain as much of the original spelling of the text word as possible. Read as *Judy shrickled and jumped up in her chair.*

$ shrickled
Judy shrieked and jumped up in her chair.

Partial Miscues
Partial miscues are marked by putting a dash after a partial word when a reader attempts but does not produce a complete word. Intonation is used to determine partial miscues.

Often readers start to say a word and self-correct or attempt a correction before a word is completed. Here, the reader predicts *ability*. He only starts the word and immediately self-corrects to *able*. Partial attempts that are corrected are marked on the typescript with a dash following the partial, but are not transferred to the coding sheet.

There is nothing greater than man and the work

abi–
he is best able to do.

Repeated Miscues
Repeated miscues are marked with an (RM) to indicate the same miscue for the same text item.

come   come   (RM)
Off came our boots. Off came our socks.

Intonation Shift
An accent mark indicates intonation shifts within a word. Intonation shifts are marked only if there is a change in meaning or grammatical structure of the original text.

He will record her voice.

We want the project to succeed.

Pauses
A / marks noticeable pauses in reading. It is useful to mark the length of unusually long pauses.

23 sec.
"What do you do all day / while I am away cutting

wood?"

Dialect and Other Language Variations
Miscues that involve a sound, vocabulary item, or grammatical variation that is perceived as a dialect difference between the author and reader are marked with a (d). Read as *I switched off the headlights of the car...* and *...just about everybody like babies.*

headlights (d)
I switched off the headlamps of the car...
like   (d)
...just about everybody likes babies.

Goodman, Y., Martens, P., & Flurkey, A. (2014). *The essential RMA: A window into readers' thinking.* Richard C. Owen Publishers, Inc.