2021

Metacognitive Strategies Used for Reading Comprehension Among Adult Postsecondary Learners

Mary Lukes
Walden University

Walden University

College of Social and Behavioral Sciences

This is to certify that the doctoral dissertation by

Mary Lukes

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Maxwell Rainforth, Committee Chairperson, Psychology Faculty
Dr. Steven Linnville, Committee Member, Psychology Faculty
Dr. Gary Burkholder, University Reviewer, Psychology Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2021

Abstract

Metacognitive Strategies Used for Reading Comprehension Among Adult Postsecondary Learners

by

Mary Lukes

MA, [Pepperdine University], 1994

BS, [Auburn University], 1981

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Psychology

Walden University

August 2021

Abstract

A significant positive correlation between higher metacognitive strategy use and better reading comprehension among native English-speaking children and adult learners of English as an additional language, consistently presented in the literature, has not been consistently or directly found among native English-speaking adult high school graduates who enroll in postsecondary learning programs such as university programs. Consequences for adult learners with lower reading comprehension scores at college entry include significantly lower earnings over their lifespan due in part to greater risk for not completing a postsecondary program. This nonexperimental cross-sectional study was guided by two theoretical frameworks, one for adult reading comprehension and one for metacognitive reading strategy awareness, to examine the relationship between metacognitive strategy awareness and reading comprehension among native English-speaking adult postsecondary learners. Online survey data were collected from 57 participants using the Metacognitive Awareness of Reading Strategies Inventory-Revised and items from the Nelson Denny Reading Test. Linear regression analysis using vocabulary knowledge as a control variable indicated that greater metacognitive reading strategy awareness reported by a sample of adult postsecondary learners moderately predicted higher reading comprehension scores. This study may inform future exploration of metacognitive reading strategies for adult learner instruction and independent use leading to positive social change.

Metacognitive Strategies Used for Reading Comprehension Among Adult Postsecondary Learners

by

Mary Lukes

MA, [Pepperdine University], 1994

BS, [Auburn University], 1981

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Psychology

Walden University

August 2021

Table of Contents

List of Tables

Chapter 1: Introduction to the Study

Low reading comprehension scores at postsecondary program entry (i.e., any professional or vocational education beyond high school) have been suggested as one of the major causes of postsecondary program noncompletions in the United States (Juszkiewicz, 2017). Adult learners who do not complete their postsecondary programs within program time requirements earn significantly less income over their lifespan compared to adult learners who complete their postsecondary program (Gates, 2017). Remedial reading coursework has been required among an estimated 25% to 50% of native English-speaking adult learners enrolled in postsecondary programs in the United States. However, remedial coursework has not increased program completion rates among these learners (Bidwell, 2014; Camera, 2016; Juszkiewicz, 2017). Reading comprehension in the workforce is also a concern, as employers increasingly require reading comprehension testing as part of the job application process. For example, the Nelson Denny Reading Test remains one of the most widely used adult reading comprehension measures for diverse adult groups by employers and universities within the United States (Austin Police Department, 2013; Conners State College, 2019; Garden City Community College, n.d.; Lake Michigan College, 2013; Molloy College, 2014; South Carolina Police Department, 2018).

Despite consistent positive relationships between higher reading comprehension and greater metacognitive strategy (i.e., self-aware thinking, reasoning, and understanding) use during reading among children and adult second language learners (Cromley, 2005), the research remains inconclusive about the efficacy of metacognitive

strategy knowledge, awareness, and use on reading comprehension among native English-speaking adult learners enrolled in postsecondary programs (Brunswick, 2015; Norris, 2013). Increased reading comprehension could alleviate adult learner stress, as well as increase postsecondary program completion rates (Juszkiewicz, 2017). Reasons for the inconsistent support among metacognitive strategy knowledge, awareness, and use during reading comprehension among native English-speaking adult postsecondary learners in the United States are discussed in more detail in Chapter 2.

I present in Chapter 1 the literature I reviewed related to the concepts of metacognition and reading comprehension, discussed in more detail in Chapter 2. I also include in Chapter 1 a review of the concepts of metacognition and reading comprehension investigated in the fields of education, psychology, and adult learning. Some concept measures, such as the efficacy of metacognitive strategy instruction on the reading comprehension of adult postsecondary learners reported in the adult learning and education literature were considered beyond the scope of this study. I also excluded other discipline frameworks, such as physiologically based vision research frameworks of reading comprehension from my literature review. This chapter focuses on how self-reported metacognitive strategy use is believed to aid the reading comprehension of native English-speaking adults enrolled in postsecondary programs.

Background

The efficacy of metacognitive strategy use for reading comprehension among children and adult second language learners enrolled in postsecondary programs outside of the United States where English is not the official language has been consistently

documented (Cromley, 2005; Mokhtari & Reichard, 2002; Sheorey & Mokhtari, 2001). However, this efficacy has not consistently been found among native English-speaking adult learners enrolled in postsecondary programs in the United States (DeBoy, 1991; Herrmann, 1996; Reid, 2013; Williams et al., 2007). The efficacy of metacognitive strategy knowledge, awareness, and use for adult reading comprehension has been sparsely documented in peer-reviewed literature in the fields of education, psychology, and adult learning (Cromley, 2005; Norris, 2013). More peer-reviewed literature exists relating cognitive components such as word processing, working memory, and vocabulary knowledge to reading comprehension than relating higher order processes to reading comprehension (Hannon, 2012).

Some positive relationships between higher reading comprehension scores and greater metacognitive strategy awareness and use during reading have been documented among the population of native English-speaking adult postsecondary learners (Mokhtari et al., 2018; Sheorey & Mokhtari, 2001). Positive trends and small positive correlations among reading comprehension and metacognitive strategy use resulted in little support of metacognitive strategy exploration among adult native English-speaking postsecondary learners in the United States. Prior studies of this population have included different measures of reading comprehension and metacognitive strategy use that make comparisons across the population difficult to generalize. These studies are discussed in detail in Chapter 2.

Problem Statement

Reading skills are important for postsecondary achievement and program completions, as well as for greater earning potential and social participation in more technical societies worldwide (Afdaleni, 2013; Zhang & Sepho, 2013). One approach that has been incorporated into interventions to aid adult reading comprehension has been the instruction in metacognitive strategies such as comprehension monitoring, rereading text, and other behaviors that help adult readers regulate incoming information and overcome reading comprehension failure (Cubukcu, 2008; Estacio, 2013; Singhal, 2001). Metacognitive interventions that aid reading comprehension are based on the assumption that readers who use more metacognitive strategies have higher reading comprehension (Amzil, 2014; Cromley, 2005; Little, 1999; Norris, 2013; Sheorey & Mokhtari, 2001; Taraban et al., 2000, 2004). If this assumption is correct, then adults' higher reading comprehension scores should correlate with higher use of metacognitive strategies.

Studies that addressed the relationship between reading comprehension and metacognitive strategy use among adult postsecondary learners are discussed in more detail in Chapter 2. Most of these researchers used different operational definitions and measures of metacognition and reading comprehension concepts and reviewed theoretical frameworks of metacognition believed to relate to adult reading comprehension without basing study results on such a framework. None of these researchers used a standardized measure of metacognition and reading comprehension as part of the study protocol among a sample of native English-speaking adult postsecondary learners in the United States, although previous scores on national college-entry reading comprehension exams

were used in some studies (DeBoy, 1991; Taraban et al., 2000, 2004). Weaknesses of the previous studies are further detailed in Chapter 2, along with theoretical models that relate reading comprehension to metacognitive strategy use. The research problem that the current study addressed was that it is not reliably known from previous research whether adult postsecondary learners' reading comprehension is correlated with their use of metacognitive strategies during reading.

Purpose of the Study

The purpose of this quantitative study was to examine the relationship between metacognitive strategies (independent or predictor variable [IV]) reported by a sample of adult undergraduate participants to aid their reading comprehension (dependent or outcome variable [DV]). Regression statistical analysis addressed the self-report measure (IV) on the Metacognitive Awareness of Reading Strategies Inventory-Revised (MARSI-R; Mokhtari et al., 2018) of reader metacognitive strategies used by adult learners for reading comprehension (DV) on the Nelson Denny Reading Test's Reading Comprehension Form G subtest (ProEd Inc., 1993). The Nelson Denny Reading Test's Vocabulary subtest (ProEd Inc., 1993) controlled for possible reader differences in vocabulary knowledge (control variable) previously found to impact higher reading comprehension.

The 80 vocabulary items progressively increase in difficulty on the Nelson Denny Reading Test (ProEd Inc., 1993). These items are based on the test development criteria discussed in Chapter 3 and expected to be familiar to postsecondary adult learners upon which the test was developed. Based on a G*Power analysis, a sample of 120 participants

age 18 years and older who were enrolled in a postsecondary program in the Midwest United States was recruited for the study. Consenting participants remained anonymous and completed a single research contact online. This 20-minute or less online format was a necessary change due to COVID-19 mandates that closed campuses where the proposed 60-minute group seating session for the silent reading and writing tasks of the study was originally planned.

Research Question and Hypotheses

Research Question: Does metacognitive strategy use during reading relate to better reading comprehension among adult postsecondary learners?

H_o: The use of metacognitive strategies during reading, as reported by adult learners on the Metacognitive Awareness of Reading Strategies Inventory-Revised (MARSI-R) does not predict reading comprehension measured by scores on the Nelson Denny Reading Test (NDRT) Reading Comprehension subtest after controlling for the variable of vocabulary knowledge using the NDRT-Vocabulary subtest.

H_a: The use of metacognitive strategies during reading, as reported by adult learners on the Metacognitive Awareness of Reading Strategies Inventory-Revised (MARSI-R) is positively correlated with reading comprehension scores on the Nelson Denny Reading Test (NDRT) Reading Comprehension subtest after controlling for the variable of vocabulary knowledge using the NDRT-Vocabulary subtest.

Theoretical Frameworks

Concepts believed to interact in cyclical fashion during reading were discussed within the interactive reading comprehension framework of the landscape model (see

Yeari & van den Broek, 2011). The landscape model of reading comprehension acknowledged automatic cognitive processes of readers triggered by reader memory, and reader-initiated cognitive processes such as rereading that interacted to result in inferencing that aids reading comprehension (Yeari & van den Broek, 2011). Yeari and van den Broek's (2011) concepts of automatic and strategic cognitive processes during reading fit with passive and active cognitive processes applied to reading comprehension in Efklides's (2014) enriched model of metacognition.

A second theoretical framework included metacognition processes in reading comprehension within the enriched model of metacognition (see Efklides, 2008, 2014). The enriched model of metacognition describes how lower order cognitive processes such as memory and learning activate and interact with higher order cognitive processes such as self-regulation that occur through metacognitive awareness, metacognitive knowledge, and metacognitive monitoring to aid reading comprehension (Efklides, 2008, 2014). The different aspects or levels of metacognitive processes defined in the enriched model of metacognition theoretically relate to reading comprehension (Efklides, 2014). Examples of metacognition aspects include readers' calibration or accuracy in these readers' metacognitive perceptions about their topic knowledge, recall of word meanings, and recall of sentence meanings (Efklides, 2014).

Readers' metacognition or use of thought processes related to text topic knowledge is believed to be a phenomenon of readers making connections between text being read and readers' goals or anticipated future use of the text content (Efklides, 2014; Yeari & van den Broek, 2011). Higher levels of organization, selection, and use of

cognitive processes such as short-term memory, long-term memory access, knowledge, and planning have been linked to higher reading comprehension among children and adult second-language learners (Cromley, 2005; Norris, 2013). If metacognition strategies aid reading comprehension in the same way that topic knowledge aids reading comprehension, the direct measurements of metacognition aspects should yield positive relationships with higher reading comprehension scores among adult readers.

Nature of the Study

The independent variable of metacognitive strategy use in this quantitative study was hypothesized to correlate positively and predict the dependent variable of higher reading comprehension scores on a randomly selected single standardized reading comprehension test item. A control variable of differences in vocabulary knowledge was used in the multivariate regression analysis. The metacognitive strategy measure (MARSI-R; Mokhtari et al., 2018) records an overall score and three subscale scores specific to enhancing reading comprehension. The Nelson Denny Reading Test's (NDRT) Reading Comprehension items (ProEd Inc., 1993) are considered a valid indicator of an adult reader's level of academic text content comprehension. The NDRT Vocabulary subtest (ProEd Inc., 1993) was anticipated to remain a valid indicator of activated academic knowledge within the study sample, as well as to control for individual differences in printed word recognition with or without this activated academic vocabulary knowledge.

The feasibility of obtaining a sample size necessary for completing such measures or of finding participants who would complete several long measures was a consideration

among college student populations. The compensation strategy for this study was changed when an online recruiting partner was sought; the recruiting partner compensated online participants for their survey time. This change was necessary to recruit the minimum number of volunteer participants required to complete all study tasks.

Definitions

Calibration: Reader judgments about their reading comprehension that range from approximations to absolute accuracy during metacognitive monitoring (Efklides, 2014). Calibration is unrelated to knowledge, and readers with higher reading comprehension are believed to have better calibration resulting in better reading strategy selections compared to readers with lower reading comprehension (Efklides, 2014).

Cognitive strategies: Cognitive processes such as memory, topic knowledge, and the reader's ability to create coherence between prior text read and current text being read for reading comprehension (van den Broek & Espin, 2012). The effectiveness of these processes depends on how explicitly the text presents an idea (van den Broek & Espin, 2012).

Metacognitive awareness: A participant's metacognitive awareness of their thinking and selection of reading-related strategies such as organizing text information for better comprehension (Rapp et al., 2007).

Metacognitive monitoring: Conscious or active levels of processing text, such as identifying contradictions in text and hypothesizing about text meaning or future use (Efklides, 2008, 2014), as well as passive recognition or nonconscious processing of

one's emotions or judgments during reading (Efklides, 2008, 2014; van den Broek & Espin, 2012; Yeari & van den Broek, 2011). Metacognitive monitoring during reading comprehension cues the reader when reading comprehension has failed (Schommer & Surber, 1986).

Assumptions

The concepts described in the literature that link metacognition to reading comprehension among adult learners are believed to accurately reflect reading processes. For example, higher metacognitive strategy awareness and use exists with higher reading scores based on previous comparisons (Mokhtari et al., 2018; Sheorey & Mokhtari, 2001; Taraban et al., 2000, 2004). Participants' academic reading ability at the post-high school and college entry level was assumed, regardless of previous reading history. Participants' perception, accuracy, and honesty in reporting their metacognitive reading strategy awareness and use during the study reading tasks was also assumed.

The use of standardized measures for the independent and dependent variables was assumed to accurately assess both reading comprehension and metacognitive strategy use while reading. Given the impact of COVID-19 on my ability to conduct the study in person as the standardized NDRT required, adapting the NDRT for the purpose of the current study was considered a better option for measuring the dependent and control variables than using less formal measures for this study's purpose. The full NDRT (dependent and control variable measures selected) was standardized, developed, and normed on adult college learners and was assumed to be a less biased measure of reading comprehension and vocabulary word knowledge than less formal measures of reading

comprehension and vocabulary knowledge. Given the adapted measures used and the standardized independent measure (MARSI-R) used, the study tasks and online study participation were assumed to be nonthreatening to participants' esteem and their current educational goals.

Scope and Delimitations

The scope of this study was limited to examining the metacognitive strategy use reported for reading comprehension among native English-speaking adult postsecondary learners enrolled in at least one undergraduate course. Regression results may not be generalizable to all learners in the sample or to other postsecondary undergraduate learners not sampled for this study. The instruments used for each variable have strong internal reliability and construct validity, as they were developed on and continue to be used with adult learners (Mokhtari et al., 2018; ProEd Inc., 1993). The adapted shortened NDRT Form G subtest items used for the current study limited the reliability of the study measures of reading comprehension and vocabulary knowledge.

Limitations

The study design included a single group measure of reading scores, vocabulary knowledge scores, and metacognitive strategy scores reported by participants. The inclusion of a control group or delineating adult learners according to years of education experience may identify more conclusive evidence of the impact of metacognitive strategy awareness and use on reading comprehension. However, the inclusion of groups for comparisons was anticipated to result in group sizes too small for such comparative analyses. Linear regression showed the strength of variable relationships that may relate

to factors such as the sample's years of undergraduate postsecondary program enrollment or age group that can be explored in future studies to identify potential causes of significant relationships.

The lack of a single theoretical framework limited interpretations of the moderate positive relationships found among study variables. However, the concepts describing similar reading and metacognitive processes helped strengthen support for relationships among variables. The use of two theoretical frameworks, one for reading comprehension and one for metacognition, provided the basis for discussing the meaning of direct relationships between reading comprehension and metacognition scores. These frameworks served to limit bias or assumptions by me regarding possible implications of direct relationships between reading comprehension scores and metacognitive strategies reported by participants.

Ethical Protections

Participants were to be recruited from a host campus after the Walden University Institutional Review Board (IRB) approved the study and the host campus agreed to host the study. The host campus would have provided me with a targeted undergraduate group of adult learners enrolled in undergraduate courses for campus recruitment of potential study participants. Participants were to meet with me on campus at a specified location, day, and time designated by the host campus. Participant consent was to be obtained and kept by me separate from data collected for the study on campus.

Data collected were to be written on precoded paper for matching individual participant metacognitive strategies reported with their reading comprehension scores and

their total listed word recognition score. A demographic data page requesting each participant's number of years in their undergraduate program (first year, second year, or third or more years) and age in years was also to be precoded for group analyses. Higher chronological age and greater number of formal education years have been linked to higher metacognitive strategy use for reading comprehension (Mokhtari et al., 2018; Mokhtari & Reichard, 2002).

Significance

Study participants' reading and metacognition scores without exposure to metacognitive strategy instruction or intervention in the study helped identify whether metacognitive strategy awareness or use was common among participants with higher reading comprehension scores. The moderate positive relationships among study variables may guide future research regarding possible causes of higher reading comprehension scores that may or may not relate to higher metacognition scores. Relationships between metacognition and reading comprehension scores within one group of adult postsecondary readers found within other groups of adult postsecondary learners may be further explored to clarify whether metacognitive aspects directly or indirectly enhanced reading comprehension.

Summary

This chapter presented literature findings on adult learner reading comprehension and metacognition from different field views such as education and psychology. Two frameworks, one for reading comprehension and one for metacognition, provided the basis for exploring the relationship of metacognitive strategy use during adult reading

comprehension through regression analyses. A control variable reduced the impact of one confounding factor (vocabulary knowledge differences) on reading comprehension scores among the sample of adult readers. Adult reading comprehension has also been explored through disciplines such as vision research, public health, and neuroscience research (McCray, 2005). However, this study focused only on the education and psychology frameworks of reading comprehension and metacognition. Chapter 2 addresses metacognition in more detail specific to adult reading comprehension.

Chapter 2: Literature Review

This chapter addresses the literature on metacognitive strategies that enhance adult postsecondary learners' reading comprehension. As many as 50% of adult learners enrolled in postsecondary programs who require remedial reading coursework (Bidwell, 2014; Camera, 2016) and who do not complete their university programs face significant social and economic barriers (Gates, 2017). Despite strong support for the efficacy of metacognitive strategy use for reading comprehension among children learning to read (Cromley, 2005) and among adult learners for whom English is an additional language (Estacio, 2013), the literature indicated inconsistent findings regarding the efficacy of metacognitive strategy use for reading comprehension among native English-speaking adult learners (Little, 1999; Reid, 2013; Taraban et al., 2000, 2004). This chapter shows the sparse literature in regard to native English-speaking adult postsecondary learners' metacognitive strategy use for reading comprehension compared to the more abundant literature supporting metacognitive strategy use for reading comprehension among adult learners whose native language is not English.

The relatively few studies on metacognitive strategy use for reading comprehension among native English-speaking adult postsecondary learners included different theoretical constructs of metacognition such as metacognitive strategy awareness, metacognitive knowledge, or metacognitive strategy use. These studies also incorporated different measures of reading comprehension such as self-reported reading comprehension, course grades, or reading comprehension scores obtained from sources external to the study such as national or state college entry exam scores in reading

comprehension. These study factors and other study design weaknesses may explain the lack of consistent findings across the studies gathered from this literature review.

Two reading comprehension and metacognition frameworks formed a basis for examining metacognitive strategy use during reading comprehension among a sample of adult postsecondary learners whose first or native language was English. Metacognitive strategies with the strongest empirical ties to adult reading comprehension were presented. In this chapter, the literature search strategies and theoretical frameworks for reading comprehension and metacognition are discussed first. The frameworks selected for the basis of this study included the landscape model of reading comprehension and the enriched model of metacognition.

Cognitive factors found to contribute to reading comprehension and metacognition are then presented as relevant to the selected theoretical frameworks for this study. Metacognitive processes theorized to aid reading comprehension are discussed in relation to the evidence that metacognitive strategy instruction and use aid adult reading comprehension. The study design and measures used to report this evidence in the literature are more thoroughly discussed, followed by discussion of a metacognitive strategy use measure specific to adult postsecondary learner reading comprehension as most relevant to this study's examination of adult metacognitive strategy use during reading.

Literature Search Strategy

A literature search using the keywords *reading comprehension*, *metacognition*, *metacognitive strategy*, *first language English speaking*, and *adult learner* with the

ProQuest and Google Scholar online search engines indicated studies purporting to measure both reading comprehension and metacognitive strategy awareness or use among native English-speaking postsecondary adult learners. However, most of the studies obtained from this search involved nonnative English-speaking learners who were studying English in postsecondary programs outside the United States, or adult learners who were native English-speaking adults enrolled in adult basic education or high school diploma equivalency courses in the United States.

Only the studies that included both a measure of reading comprehension and of metacognitive strategy use among adult native English-speaking postsecondary learners are discussed in this chapter. There was no time span limitation applied to the literature searches because there were so few studies that included both measures of reading comprehension and metacognitive strategy scores. Theoretical frameworks that rationalize the use of metacognition during adult reading comprehension are also discussed.

Reading Comprehension Processes

Reading is a behavior with the purpose or anticipated outcome product of reading for comprehension (Tarchi, 2017; van den Broek & Espin, 2012). Reading comprehension has been described as the result of an interaction of cognitive processes such as a reader's language skills, and with textual content knowledge (van den Broek & Espin, 2012). These cognitive processes rely on the interaction of a reader's effortful memory retrieval processes with autonomous associations activated in a reader's knowledge base through semantic and episodic memory (Yeari & van den Broek, 2011).

In addition to lower level cognitive processes, higher order processes are also believed to play an important role in reading comprehension (Hannon, 2012; Ready et al., 2013; Yeari & van den Broek, 2011). These higher order processes are believed to facilitate self-regulated learning during many kinds of learning tasks (Diamond, 2013) including reading (Efklides, 2008).

Two theoretical models provide a useful basis for understanding the role of metacognitive processes in reading comprehension. The landscape model of reading comprehension provides a theoretical framework for understanding how lower order and higher order processes facilitate the construction of mental representations of textual meaning during reading (van den Broek & Espin, 2012; Yeari & van den Broek, 2011). Although the landscape model recognizes the broad role of higher order processes that leads to selecting strategies such as rereading text for reading comprehension, it does not identify metacognitive processes believed to be vital to the interaction with lower order cognitive processes for reading comprehension (Rapp et al., 2007).

Efklides's (2008, 2014) enriched model of metacognition emphasizes the importance of self-regulation during learning and recognizes the roles of conscious and nonconscious processes as factors that contribute to learning. This model of metacognition incorporates a broad theoretical view of metacognition that could be applied to reading comprehension (Efklides, 2008, 2014). After separately presenting van den Broek's reading comprehension model and Efklides's metacognition model, I present these models' compatibility and basis for understanding the role of metacognitive processes during reading.

Landscape Model of Reading Comprehension

The landscape model of reading comprehension posits that basic cognitive processes, such as word recognition, vocabulary knowledge, and short-term memory, play a foundational role in enabling a reader to decode meaning from text during reading and contribute to the outcome of reading comprehension (van den Broek & Espin, 2012). These basic cognitive processes reflect passive cognitive processes that interact with active cognitive processes such as intentional text and memory searching for related information to the reading content (van den Broek et al., 2005; Yeari & van den Broek, 2011). Readers engage active cognitive processes in response to reading comprehension failure to enhance mental representations of text meaning (van den Broek & Espin, 2012).

The quality of mental representations that readers create about text meaning rely on readers' active hypotheses about how much sentence sequences relate to or conflict in relation to the text topic (van den Broek et al., 2002). This active cognitive processing of text information leads to readers' hypothesizing about text meaning if text and reader memory searching do not result in satisfactory reading comprehension according to the reader's expectations (Yeari & van den Broek, 2011). Hypothesizing is considered a higher order cognitive process (Yeari & van den Broek, 2011), while judging one's reading comprehension level as unsatisfactory to activate hypothesizing is indirectly indicated as a higher order process in the landscape model.

Passive and Active Processes

Hypothesizing about text meaning involves readers' connecting explicit and implicit information to make inferences about text just read, according to the landscape model of reading comprehension (Virtue et al., 2006). Another method of creating meaning from text is bridging, which reflects the process of connecting text just read with reader predictions about text not yet read (Virtue et al., 2006). Bridging requires looking backward and forward in text in repeated cycles that require proficiency at both the passive and active levels of information processing (van den Broek & Espin, 2012). Passive information processing using lower level cognitive processes such as memory is believed to interact with active search strategies for information either from activation cued by text content or the reader's knowledge associated with text content (van den Broek & Espin, 2012; Yeari & van den Broek, 2011). If text does not adequately explain information to maintain passive cognitive processing, readers will engage active cognitive processes to create inferences based on their personal knowledge or experiences that explain the text from their viewpoint (Sundermeier et al., 2005).

The interaction of passive and active cognitive processes reflects a balance of activation and reactivation of information or ideas from previous reading as well as from a reader's background knowledge when the text or reader does not contain enough information to establish text coherence according to the reader's expectations or standards (van den Broek & Espin, 2012; Yeari & van den Broek, 2011). Passive memory-based processes are considered automatic associative processes outside of readers' awareness, while active cognitive processes are considered constructionist

processes that reflect readers' intentional creation of text meaning based on readers' background knowledge and prior text readings (Yeari & van den Broek, 2011). The interaction of these automatic and reader-initiated strategic processes during reading results in a mental representation of text meaning based on a reader's standard of coherence or relations among text elements, the reader's understanding of past text content, and the reader's interpretation or expectation of current text content (Yeari & van den Broek, 2011).

Different standards of coherence created by readers are believed to help explain differences in reading comprehension, in much the same way that differences in text structure, reader strategies used for reading comprehension, reader memory, and reader background knowledge may help explain different reading comprehension levels (Yeari & van den Broek, 2011). Readers' decisions to engage in active or passive strategies while reading affect the quality of mental representations of text (van den Broek & Espin, 2012). These premises that describe the processes of readers' interpretation of text explain how reading comprehension levels can differ in recall quantity or accuracy related to text content (van den Broek et al., 2002).

Inaccurate text comprehension or memory for text meaning can result in inaccurate inferences and misconceptions if constructionist processes conflict with each other or if activated memory is irrelevant to text meaning (van den Broek et al., 2005). Misconceptions can be strengthened by text features that are weakly related to inaccurate inferences activated by readers' associations, which in turn do not resolve reading comprehension failure (Sundermeier et al., 2005). Misconceptions further strengthen with

each reading cycle of incorrectly associated information, both during and after reading is complete (Kendeou & van den Broek, 2007; Narvaez et al., 1999; Tzeng et al., 2005).

Cognitive Factors Involved in Reading

Three cognitive abilities found to correlate with reading comprehension are vocabulary knowledge, visual word recognition, and working memory. Rayner et al. (2011) supported that visual and phonological word recognition reflected recognition of word meanings accessed from long-term memory, as well as reflected short-term memory access for word recognition. Stronger short-term memory for both visual and verbal information correlates with better reading comprehension and delayed recall of reading information (Andrews & Hersch, 2010; McGettigan et al., 2011; Waechter et al., 2010, 2011).

Visual short-term memory for letter and word location correlates with faster reading times, although not necessarily better reading comprehension (Dubois et al., 2009; Makovski et al., 2008; Wolf et al., 2000). Buchweitz et al. (2009) found that adults with lower working memory activated more prefrontal cortex area on neuroimaging tests that indicated executive functioning compared to adults with higher working memory that activated the left lateral and inferior areas, indicating language comprehension while reading for comprehension. Similarly, Lepine et al. (2005) demonstrated how continuous attention switching between processing information and storing text information during reading deteriorated reading comprehension as reading speed increased. These findings reflect the use of cognitive processes such as memory, language knowledge, and attention while adults read for comprehension.

Memory is considered a constructive passive or active process that results in the product of adult reading comprehension (van den Broek et al., 2005; Yeari & van den Broek, 2011) as well as a constructive conscious and nonconscious process about emotion and thought that results in awareness, learning, and adult reading comprehension (Efklides, 2008, 2014). Behavioral self-report measures of lower order processes such as orthographic and phonological memory during printed word recognition have correlated with readers' recall of word meanings, text content knowledge, and oral word reading accuracy and speed (Goodman & Johnson, 2011; Rayner et al., 2011; Taylor et al., 2011). Behavioral self-report measures of higher order processes such as metacognitive strategy use through self-monitoring or self-regulation of cognitive effort, thought, and attention to text have correlated with higher memory for text and higher adult reading comprehension scores (Baker, 1989; Diamond, 2013; Efklides, 2008, 2014; Taraban et al., 2004). Other researchers agreed that higher order processes are involved in adult reading comprehension (Hannon, 2012; Yeari & van den Broek, 2011).

Metacognitive Processes Relevant to Reading

Flavell (1979) suggested that a student who has greater awareness of the cognitive processes involved in learning will have greater control over these cognitive processes and will be a more effective learner. Flavell introduced the term *metacognition*, which he defined as one's awareness and thoughts about one's thinking process. Although cognition involves construction of an internal representation of external experience, metacognition involves construction of a higher order or larger representation of one's cognitive processes and knowledge (Flavell, 1979).

Metacognitive processes are believed to be responsible for effective cognitive strategy awareness and selection so that new information becomes integrated with old information, resulting in learning and comprehension processes (Efklides, 2014). Metacognition also enables self-regulation of learning and behavior through two basic functions: the monitoring and control of cognition (Diamond, 2013; Efklides, 2008). Flavell's (1979) three main aspects of metacognition are

1. feelings of confidence in one's judgments about their knowledge, learning, or thinking while learning;
2. awareness of one's knowledge accessed from memory, awareness of one's beliefs about thinking, and awareness of the criteria that one uses to gauge the validity of knowledge and thinking; and
3. control of higher order or metacognitive strategies and skills such as planning, monitoring, and evaluating the thinking and actions of oneself and others.

Metacognitive knowledge is activated by a deliberate search for missing information one believes is needed for a situation, as well as activated "unintentionally… and automatically by retrieval cues in the task situation" (Flavell, 1979, p. 907). Thus, metacognitive strategies in general reflect individual beliefs about one's thinking, feeling, and judgments about self and others (Baker, 1989; Flavell, 1979). Metacognitive monitoring of these metacognitive strategies has been considered necessary for language and communication development and the development of social cognition, memory, attention, self-control, and personality (Flavell, 1979).

Enriched Model of Metacognition

Metacognition enables self-regulation of learning and behavior through two basic functions, the monitoring and control of cognition (Efklides, 2008). In the case of reading, the monitoring function would involve awareness of the cognitive processes involved in reading, and whether the processes are yielding a coherent understanding of the text. Based on the monitoring of cognitive processes, the metacognitive control function should indicate how cognitive processes need to be reoriented, when the learning process is not progressing towards its goal, so as to adjust the working of learning activities (Efklides, 2014).

Metacognition explains how people process and evaluate the accuracy of information they process through the interaction between judgments about others and oneself, self-monitoring or physiological awareness, and self-control at three different levels: social, personal, and nonconscious (Efklides, 2008). Efklides's (2008, 2014) enriched model of metacognition seeks to explain self-regulation of learning and behavior by identifying three main levels of metacognitive functioning

1. The ordinary level of cognitive functioning is the "object" level, as cognitive processes and information processed at this level are the object of higher order metacognitive monitoring and control processes;
2. A higher order or "meta" personal level of awareness of one's knowledge and monitoring of one's object level cognitive processes; and
3. A "meta-meta" social level, which incorporates socially shared and socially mediated level of metacognitive knowledge, metacognitive skills, and

metacognitive judgments, based on social interactions and feedback received from others.

According to Efklides (2014), metacognition involves the interaction of all three levels, object, personal, and nonconscious levels through metacognitive monitoring and control processes that activate and select cognitive strategies needed. These three levels of information processing form a memory-based structure of metacognitive self-regulation or control that is activated and affected by one's metacognitive monitoring accuracy (Efklides, 2014). Metacognitive experiences or judgments about one's learning, and metacognitive knowledge that is declarative knowledge are part of nonconscious and conscious self-regulation or metacognitive monitoring (Efklides, 2014).

Based on Flavell's (1979) multidimensional concept of metacognition as knowledge awareness, knowledge monitoring, and evaluation and control of one's thinking and learning processes; the enriched model of metacognition describes how these metacognitive processes activate and interact to enhance learning across three levels: social interaction, personal, and nonconscious level (Efklides, 2008, 2014). These three levels of metacognition are believed to interact in cyclical phases of planning, activating, monitoring, controlling, and reflecting on one's behavior, feelings and learning in specific contexts (Efklides, 2014).

The social level of metacognition develops from interpersonal interactions that influence learner affect and motivation for learning, and results in learning differences among people (Efklides, 2008, 2011). Social level memories of past learning experiences and feelings related to learning experiences also influence metacognitive knowledge

(Efklides, 2008, 2011, 2014). Social memories of knowledge and emotion exist at a nonconscious level; yet, they can emerge into conscious awareness when activated by familiar cues, either intrinsically at the person level or extrinsically at the task by person level (Efklides, 2011, 2014).

The personal level of metacognition involves awareness of metacognitive knowledge in the form of judgments or estimates of task difficulty, cognitive states such as curiosity, awareness of problems and the need for help, and the use of strategies or coping experiences in response to past learning or performance (Efklides, 2011). The personal level of metacognition is considered the intermediary between the deepest nonconscious metacognitive level and the surface social metacognitive level in the enriched model of metacognition, although each level is considered reciprocal when sharing metacognitive information before, during, and after task initiation (Efklides, 2008, 2011).

Cognition is automatic within the nonconscious metacognitive realm and not under metacognitive control until automatic cognition fails; this failure then activates metacognitive control (Efklides, 2011, 2014). Metacognitive control that emerges from metacognitive monitoring can result in either effective or ineffective metacognitive or cognitive strategy or skill activation (Efklides, 2011, 2014). Just as metacognitive control emerges into conscious awareness to activate skills believed to aid failing cognition, so can emotions activated in the nonconscious level emerge into conscious awareness to actively monitor and control information encoding, as occurs during reading comprehension (Efklides, 2014).

Efklides (2014) explained that the enriched model of metacognition "makes explicit the facets of metacognition, namely metacognitive experiences (ME), metacognitive knowledge (MK) and metacognitive skills (MS). Furthermore, it distinguishes three levels of functioning of metacognition." (Efklides, 2014, p. 3). Efklides (2006, 2014) distinguished between these three aspects of metacognition.

1. Metacognitive experiences take the form of metacognitive feelings (e.g., feeling of confidence) and judgments (e.g., judgment of learning) related to one's cognitive processing about the task as the person works on the task (Efklides, 2006).
2. Metacognitive knowledge is declarative knowledge about persons, tasks, strategies, and goals.
3. Metacognitive monitoring and control are related to cognition and knowledge of what needs to be done (Efklides, 2014).

Nonconscious metacognitive monitoring and control processes existed with conscious processes at a personal awareness level, as when one encounters similar tasks in different situations (Efklides, 2014). Nonconscious processes also existed with a metacognitive social awareness level process reflected in thoughts and feelings that emerge when one compares oneself to others (Efklides, 2014). Emerging awareness of one's emotions reflected nonconscious and conscious thinking or inferring about their emotional experiences (Efklides, 2014). This awareness led to immediate nonconscious control decisions or judgments about one's emotions, and to delayed conscious control decisions based on analysis of one's metacognitive experiences, including current

experiences of affect and judgments about one's ability in relation to the current task difficulty (Efklides, 2008).

This multi-aspect view of metacognition monitoring of one's knowledge, affect, experiences and skills led to self-regulated learning via "vicarious experiences ...social feedback... and persuasion" (Efklides, 2011, p.8). Self-regulation occurred via two internal feedback loops, the affective and cognitive regulatory loops (Efklides, 2008). Emotions emerging and monitored within the affective regulatory loop affected one's thinking, while thinking emerging and monitored within the cognitive regulatory loop affected strategies selected and used during learning (Efklides, 2011).

Metacognitive control developed through social interactions from instruction and feedback on collaborative activities (Efklides, 2014). Metacognitive control included awareness of cognitive control strategies such as increasing time, attention, response inhibitions, updating, and shifting attention for task initiation and termination (Efklides, 2014). Metacognitive control followed metacognitive monitoring that identified reading comprehension failure through recognition of the absence of cognitive activity or information processing unable to resolve conflicts, or erroneous expectations that resulted in lower recall (Efklides, 2014). Lower text recall affected metacognitive knowledge that is updated before, during, and after reading (Efklides, 2008). Updating included pre and post reading activities such as: beliefs about text validity, and the accuracy of one's and others' thinking, knowledge, and world beliefs (Efklides, 2008).

This metacognitive knowledge and control relied on declarative memory to communicate knowledge to others, and to self-reflect, infer, and self-regulate using one's

knowledge (Efklides, 2008). Metacognitive monitoring and evaluating text while reading is believed to help a reader identify when they matched the author's goals for text application, which strengthened the reader's connection to and memory for the text content (Efklides, 2008, 2014). Awareness of a lack of connection with the text reflected awareness of a need for metacognitive control strategies that could increase reading comprehension, such as increasing reading time or attention to text, and updating previously organized knowledge (Efklides, 2014). Thus, metacognition also appears necessary for reading comprehension to occur.

Parallels Between Models

Both the landscape model of reading comprehension and the enriched model of metacognition models seek to explain adult reading comprehension through lower order processes of memory for text and knowledge related to text content, as well as higher order processes of metacognitive awareness of comprehension failure and strategy selection to resolve comprehension failure. Higher order processes such as activating prior knowledge and reader goals for reading text maintain reader attention and short-term working memory for relevant text information in the landscape model (Kintsch & van Dijk, 1978; van den Broek, 2012).

The landscape model describes the interaction between these processes, while the enriched model of metacognition describes reciprocal relationships among these processes (Efklides, 2008, 2014; van den Broek, 2012). Efklides (2014) applied the enriched model of metacognition to reading for comprehension in the following example.

> To illustrate the processes involved at each level of metacognition, one can take the following example regarding text comprehension. During reading, monitoring at the object level informs on the fluency of the meaning-making process (comprehension); as long as the comprehension process runs automatically, one goes on with text reading. If, however, comprehension fails temporarily, then monitoring informs control, and reading is slowing down (more attention being given to the phrases that do not make sense). The effortful processing is manifested in the recursive eye movements during reading without the person being aware of the back and forth eye movements. However, the person is not aware of the control being exerted as long as cognitive processing is restored without a major break down. If, on the other hand, despite automatic regulation, cognitive processing is not restored (e.g., comprehension processes fail), then the person becomes consciously aware of the lack of progress in cognitive processing. Thus, the outcome of non-conscious monitoring and control can reach the level of conscious awareness (personal awareness level) in the form of metacognitive feelings or judgments. (Efklides, 2014, p.3)

The enriched model of metacognition (Efklides, 2008, 2014) applied to reading comprehension focuses on reader characteristics such as nonconscious and conscious emotional and thinking processes before, during, and after reading rather than text characteristics; while the landscape model of reading comprehension incorporates reader and text aspects through a balance of passive and active information seeking as information or ideas are activated by prior reading (van den Broek & Espin, 2012; Yeari

& van den Broek, 2011). Yet, these models contain common elements in that both models acknowledged the use of lower order cognitive processes of memory for metacognitive knowledge such as vocabulary meaning and visual word recognition for encoding, storage, and later access. Both models also acknowledged the use of higher order processes such as metacognitive strategy awareness, use, and selection before, during, and after reading for comprehension.

Metacognition Processes and Reading Comprehension

Two metacognitive processes, metacognitive awareness and calibration are considered important to the cognitive processes involved in reading comprehension. Metacognitive awareness of the cognitive strategies used while reading results in readers evaluating the effectiveness of their cognitive reading strategies such as rereading words in text, as well as selecting more effective reading strategies such as seeking additional information about text content (Sheorey & Mokhtari, 2001; Taraban et al., 2000, 2004). Calibration is unrelated to metacognitive knowledge, as readers evaluate themselves against criteria important to them when comprehending text (Efklides, 2014). Readers also evaluate themselves against their perceptions of others' abilities to comprehend the text they are reading (Schommer & Surber, 1986).

Schmitt and Sha (2009, p. 256) presented how perception, as metacognitive knowledge and metacognitive control contribute to comprehension, including reading comprehension. Metacognitive control is categorized as regulation through self-monitoring, self-correcting, and problem-solving skills (Schmitt & Sha, 2009). Both metacognitive knowledge and control strategies need to be provided to learners before,

during, and after reading in order to build learners' metacognitive knowledge and independent use of metacognitive strategies (Schmitt & Sha, 2009, p. 266). How metacognitive knowledge and control relate to text demands and reader demands among adult readers remain areas of need for more information for adult learners and their instructors. These self-judgments reflect reader alignment with a personal criteria-based measure of reading comprehension termed calibration.

Metacognitive Strategies Relevant to Reading Comprehension

Paris et al. (1983) categorized metacognitive strategy knowledge into three areas:

1. declarative- expressing the actual knowledge,
2. procedural- knowing when and how to apply the knowledge, and
3. conditional- knowing why the applied knowledge best fits in a specific context.

Awareness of this metacognitive knowledge has correlated with adult reader's use of specific metacognitive strategy skills such as previewing, rereading, reviewing, and outlining text information to aid reading comprehension (Sheorey & Mokhtari, 2001) and text recall (Taraban et al., 2000). Schmitt and Sha's (2009) sample of elementary school students demonstrated higher text recall when they explained text meaning compared to when these students paraphrased, predicted, or created personal associations to text.

Metacognitive Strategy Instruction Relevant to Reading Comprehension

Instruction strategies believed necessary to build metacognitive strategy knowledge and independent application by learners have been identified in the education literature. The use of diagramming concepts, creating acronyms for recall of sequential

steps or information, and asking open-ended questions rather than closed questions that contain only one right answer are considered helpful in developing learner metacognition (Ellis et al., 2013).

Instructor modeling by thinking aloud their decision making about the use of strategies, as well as explicit instruction that links abstract concepts to concrete actions or solutions have helped children learn and comprehend text (Cromley, 2005; Ellis et al., 2013). The use of rubrics that outline skill criteria or goal graphs that chart performance are other examples of instruction strategies for metacognition building (Ellis et al., 2013). Metacognition is "not memory" but one's perception of their learning and skill performance (Ellis et al., 2013, p. 116).

Such reader self-reports about metacognitive strategy use for reading comprehension indicated that explicit instruction in the application of metacognitive reading strategies would increase adult post-secondary reader comprehension of academic text. However, explicit instruction in metacognitive strategy use has not always yielded higher reading comprehension scores or greater independent use among these post-secondary adult learners (Little, 1999).

The majority of adult post-secondary learners who report using many metacognitive reading comprehension strategies on a metacognitive awareness of reading strategies inventory also report higher reading comprehension (Mokhtari & Reichard, 2002; Sheorey & Mokhtari, 2001). Yet, fewer than half of the learners exposed to metacognitive reading comprehension strategy instruction in one study had higher reading comprehension scores after this instruction (Little, 1999). Fewer than one third of

first year adult post-secondary learners with the highest reading comprehension scores on standardized reading tests in another study reported using metacognitive reading comprehension strategies on the metacognitive reading strategies questionnaire (Taraban et al., 2000). There is consensus that lower order cognitive processes such as concrete knowledge of word meanings interact with higher order processes such as inferred word meanings based on word use in specific contexts to result in adult reading comprehension (Efklides, 2014; Hannon, 2012; van den Broek & Espin, 2012).

Assessment of Metacognitive Strategies Relevant to Reading

Two standardized MC (metacognitive) strategy measures listed in Table 1, the MARSI (Metacognitive Awareness of Reading Strategies Inventory), and the MRSQ (Metacognitive Reading Strategies Questionnaire) prototype, were developed specifically for measuring MC strategies during reading among adult learners to explain their higher academic reading comprehension (Mokhtari & Reichard, 2002; Sheorey & Mokhtari, 2001; Taraban et al., 2004). Factor analyses conducted on each measure identified three MARSI subscales: Global, Problem Solving, and Support; and two MRSQ subscales: Pragmatic or cognitive, and Analytic or MC (Mokhtari & Reichard, 2002; Sheorey & Mokhtari, 2001; Taraban et al., 2000, 2004). The MARSI development did not include objective RC measures, only adult learner self-reported RC (Sheorey & Mokhtari, 2001). The MRSQ development included objective RC measures (Taraban et al., 2000, 2004).

The MRSQ's Analytic subscale and the MARSI Global subscale are examples of metacognitive (MC) strategy items related to the pre-reading phase, such as having a purpose or goal before beginning to read (Sheorey & Mokhtari, 2001; Taraban et al.,

2004). The revised MARSI (Mokhtari et al., 2018) also contains these (MC) strategy items, and is discussed in more detail in Chapter 3. MC strategies used during reading, such as slowing one's reading pace for better RC, or increasing reading speed for more familiar or text content judged less relevant to reading goals were included in the MARSI Problem Solving subscale, and were not included in the MRSQ Analytic (Sheorey & Mokhtari, 2001; Taraban et al., 2004). MC strategies during reading included visualizing information read and pausing to think about the implications of reading content on the MARSI Problem Solving subscale and the MRSQ Analytic subscale (Sheorey & Mokhtari, 2001; Taraban et al., 2004). The MC strategy item of recognizing when text fit a reader's purpose, common to the MRSQ and MARSI was measured a second time on the MRSQ Analytic subscale as a measure of evaluation or judgment about the text's usefulness to the reader (Sheorey & Mokhtari, 2001; Taraban et al., 2004).

Table 1 presents the MC strategy items of the MARSI and the MRSQ. Note that 17 MC strategies are common among the 30 MARSI items, and 22 MRSQ items. Note also that the MRSQ column does not list 22 items due to some items being measured twice on the MRSQ Analytic subscale, such as the MC strategy item related to evaluating the match between the reader's purpose and text's purpose. Specific wording differences between the two measures are noted in parentheses.

Table 1

Comparison of Metacognitive Strategies Listed on Two Metacognitive Measures

Metacognitive strategy item	MARSI subscales (2002)	MRSQ subscales (2004)
Purpose	Global	Analytic
Preview	Global	
Skim	Global	
Text fits purpose	Global	Analytic (goal fit, useful)
Identify text features	Global (text italics, tables)	
Decide what to read in text	Global	Analytic
Use text format	Global (length, organization)	Analytic (easy-hard to read)
Use context clues in text	Global	Analytic (infer meaning)
Predict text meaning	Global	Analytic (you expect it?)
Confirm your predictions	Global	Analytic (revise if needed)
Use prior knowledge	Problem solving	Analytic (link old to new)
Read aloud	Problem solving	
Slow reading pace	Problem solving	
Focus or refocus self-prompts	Problem solving	
Adjust reading pace	Problem solving	
Increase attention	Problem solving	
Pause and think	Problem solving	Analytic (consider)
Visualize text information	Problem solving	Analytic
Evaluate text understanding	Global	Analytic
Resolve conflicting text	Global	
Reread	Problem solving	Pragmatic
Guess word meaning	Problem solving	Analytic
Make notes	Support	Pragmatic
Underline text	Support	Pragmatic
Use resource/references	Support	
Paraphrase text information	Support (summarize)	
Read back and forth in text	Support (relate text ideas)	
Ask self-questions	Support	Analytic
Diagram or draw relationships		Analytic
Use text format for meaning	(determine significance)	(use knowledge not text cues)

Evidence That Instruction in Metacognitive Strategies Promotes Reading Comprehension

Remedial reading courses or instructional strategies for adult learners with low reading comprehension included explicit instruction and practice in applying metacognitive strategy knowledge during reading (Nash-Dietzel, 2010; O'Neill, 1992; Poissant, 1994). However, the positive trends or relationships between metacognitive strategy instruction and reading comprehension had no effect on program retention, which may have been due to small participant numbers in these early studies (O'Neill, 1992; Poissant, 1994).

Native English Speakers

Some college and university training programs reported mixed results when metacognitive strategy instruction was part of required program coursework. For example, positive trends or negative relationships resulted between metacognitive strategy knowledge, metacognitive strategy use, and reading comprehension measures among adult learners with more diverse reading comprehension and metacognitive strategy knowledge over a college term (Little, 1999; Reid, 2013; Royer et al., 1987; Williams et al., 2007). A weakness in the Royer et al. (1987) and Williams et al. (2007) studies was the use of course exam grades as measures of reading comprehension rather than using a standardized measure of reading comprehension to measure progress from term beginning to term end.

Adult Second-Language Learners

Post-secondary programs outside the United States of America also report increased learner metacognitive strategy use and reading comprehension among English

as a foreign language learners exposed to weekly sessions of metacognitive skills training (Amzil, 2014; Yuksel & Yuksel, 2011). Amzil (2014) found a small but significant difference after five weeks of metacognitive strategy training between the lower scores of the control course learners and the higher scores of the experimental course learners on the Test of English as a Foreign Language reading skills and the metacognitive awareness inventory (Amzil, 2014). Yuksel and Yuksel (2011) reported that all their third-year post-secondary participants reported high levels of metacognitive awareness on the survey of reading strategies due to required reading strategy coursework for English as a foreign language. Yuksel and Yuksel (2011) did not include a measure of reading comprehension in their report.

Studies Measuring Both Reading Comprehension and Metacognition

This section highlights the lack of empirical evidence that directly links MC and RC among post-secondary learners. Table 2 below contains all studies that met the criteria review inclusion measuring both reading comprehension (RC) and metacognitive strategy (MC) awareness or use among adult English speaking post-secondary learners in the United States of America. Of the six studies in Table 2, two studies used a mixed quantitative and qualitative methodology to explore the relationship between metacognitive strategy use and reading comprehension (Herrmann, 1996; Little, 1999). DeBoy (1991) used a single group correlation methodology to explore the strength of relationship between reading comprehension and metacognitive strategy knowledge. The remaining three studies used a quantitative methodology to explore the relationship

between reading comprehension and metacognitive strategy knowledge and use (Reid, 2013; Taraban et al., 2000, 2004).

Two study designs included a control group for comparisons to experimental groups; although Little's (1999) experimental group participants were enrolled in remedial reading courses that involved MC training, and Reid's (2013) experimental group participants were exposed to MC or cognitive prompts during the study's academic reading task. MC strategy training or prompting were not part of the other three study designs (DeBoy, 1991; Herrmann, 1996; Taraban et al., 2000). Reid (2013) included freshmen or first year post-secondary learners as did the other studies, while also including any undergraduate learner who volunteered to participate in Reid's study.

Table 2

Studies That Linked Metacognitive Strategy Use to Reading Comprehension Among Native English-Speaking Adult Postsecondary Learners in the United States

Authors	Sample and design	Metacognitive measure	Reading comprehension measure
DeBoy (1991)	233 freshmen: single group of Black adult learners measured after reading	MetaCognitive Questionnaire (adapted)	Scholastic Achievement Test /Stanford Diagnostic Reading Test
Herrmann (1996)	99 freshmen: 2 treatment groups. Measured after reading	Motivated Strategies for Learning Questionnaire (MSLQ)	Nelson Denny Reading Test-RC subtest (NDRT-RC)
Little (1999)	126 freshmen: 2 experimental groups, and 1 control group. Measured pre and post course	Motivated Strategies for Learning Questionnaire (MSLQ)	Nelson Denny Reading Test-RC subtest (NDRT-RC)
Reid (2013)	80 undergraduates: 3 experimental groups, and 1 control group measured after reading	Metacognitive Awareness of Reading Strategies Inventory (MARSI)	Researcher created learning module and test based on a college course textbook of photography
Taraban, Rynearson, and Kerr (2000)	115 freshman: 4 experimental groups based on high or low GPA and high or low TASP-R scores	Developed a questionnaire based on their literature search of metacognitive strategy use for academic reading	Texas Academic Skills Program-Reading (TASP-R) scores
Taraban, Kerr, and Rynearson (2004)	Two single sample groups of adult post-secondary learners: 575 and 574 each measured MC strategy use	Metacognitive Reading Strategy Questionnaire (MRSQ) validated using principle components analysis	American College Test-Reading Comprehension (ACT-RC) scores

DeBoy (1991) used two standardized reading measures, the Stanford Diagnostic Reading Test and the Scholastic Achievement Test's Reading Comprehension subtest, in order to help identify RC differences that may be correlated with MC, such as predicting RC accuracy. DeBoy (1991) asked participants to answer two MC questions, one before and one after answering multiple-choice questions on the Stanford Diagnostic Reading Test. The MC questions required participants to predict their RC scores before answering literal and inferential questions, and then to estimate after answering RC questions how many RC they answered correctly. Metacognitive judgment accuracy was scored based on the number of matches between individuals' actual RC answers on the Stanford Diagnostic Reading Test and their pre and post estimates of correct answers. Higher MC judgment accuracy correlated with higher RC scores on the Stanford Diagnostic Reading Test. However, higher MC accuracy did not predict higher RC (DeBoy, 1991). Two other measures, self-efficacy and cognitive reading strategies did not correlate with RC scores (DeBoy, 1991). Neither the MC judgment measure nor the cognitive reading strategy measure included MC strategy awareness or use.

Herrmann (1996) used the Motivated Strategies for Learning Questionnaire that contained cognitive and MC strategies, such as looking up information to increase understanding, and aid learning and RC. The NDRT-RC subtest was used as a means for study participants to record their reading experiences related to MC and learning strategy use on the MSLQ and the MMCS. Herrmann (1996) coded interview responses as cognitive based on encoding, attention, and recall strategies participants described; or as MC based on awareness, use, and perceived control of cognitive strategies selected. The

MC strategies most frequently selected for use in the study included planning goals to match the reading situation, previewing or skimming text, perceptions of one's RC after reading, and monitoring or evaluating oneself and the reading task while reading (Herrmann, 1996).

Herrmann (1996) identified a significant correlation between higher MC strategy use and perceived self-control when text was difficult for readers to understand compared to when text was easy to understand. However, MC strategy use did not significantly correlate with higher RC scores. The lack of a significant relationship between MC and RC could be due to the use of the MSLQ, developed to target MC strategies specific to learning, of which RC was considered to influence. Little (1999) used the individual MC scale items of the MSLQ, and self-reflection questions about critical thinking to measure changes in MC that may have influenced higher RC after completing one term of MC training in a college reading course. Participants were grouped according to their NDRT-RC scores.

The lowest readers of the three study participant groups significantly increased their reading comprehension scores when measured at term end, yet they reported being unaware of MC strategies as helpful to their RC (Little, 1999). The lowest RC group consistently cited the cognitive strategy of re-reading as helpful to their RC (Little, 1999). While the lowest RC group showed no significant difference in MC awareness and strategy use on the MSLQ, the two other study groups scored lower on the MSLQ-MC Self-Regulation subscale at term end (Little, 1999). The MSLQ-MC Self-Regulation subscale contains five MC items specific to reading, such as thinking about a topic and

what I am supposed to learn about it if I don't understand the reading, according to the MSLQ author (Little, 1999). There was no direct measure of specific MSLQ- MC strategy items that could be compared to RC scores in Little's (1999) study. Group mean MC strategy use scores were not positively correlated with RC at pre and post term for any group (Little, 1999). Also as mentioned in the above discussion of Herrmann (1996), the MSLQ was not designed as a MC strategy measure specific to RC.

Reid (2013) used the MARSI to measure participants' reported recall of metacognitive strategies used while reading a researcher-created digital media learning module. This module was based on a college course outline and textbook. Module completion was followed immediately by a researcher-created RC test about the module's reading content (Reid, 2013). The RC and MARSI scores of three experimental groups exposed to one of three embedded questions while reading the module text: cognitive, MC, or both question types were compared to each other and to one control group not exposed to embedded questions during module text reading (Reid, 2013).

Reid (2013) found that only the combined presence of cognitive and MC questions resulted in a positive trend that did not reach significant correlation with increased RC scores. Volunteer participants' prior knowledge from a high school elective course or life experiences related to the learning module and RC test's subject of photography may explain significant findings, as there was no pre-test to measure prior knowledge before study participation. There was no standardized measure of reading comprehension in Reid's (2013) study.

Taraban et al. (2004) sampled all college freshmen from two regional colleges in Texas to measure metacognitive strategy knowledge and use that could explain reading comprehension score, academic performance, and study behavior differences for each sample. The 22 item Metacognitive Reading Strategies Questionnaire was developed from principal components analysis of the 35 questionnaire items on their Taraban et al. (2000) prototype questionnaire (Taraban et al., 2004). However, none of the Taraban et al. (2004) questionnaire items correlated with reading scores on the national standards-based college entry exam, the American College Test Reading Comprehension section. Taraban et al. (2004) found internal construct stability and validity on their metacognitive measure with no correlation to standardized reading comprehension scores. The positive trends between higher metacognitive strategy scores and higher grade point average and reading scores at college entry on their measure's earlier version containing 35 items was not replicated in Taraban et al. (2004) two adult learner samples.

Taraban et al. (2000) recruited college freshmen from introductory psychology courses and developmental reading courses to measure metacognitive strategy use, academic achievement, and reading comprehension scores. These adult learners were divided into four groups based on high or low RC scores on the Texas Academic Skills Program- Reading (TASP-R) test, and high or low Grade Point Average at college entry (Taraban et al., 2000). Taraban et al. (2000) used the TASP-R due to its predictive ability to identify college learners at risk of failure and college learners with the ability to succeed in college. The sample age ranged from 17 to 34 years old, and 73% of the sample were female learners (Taraban et al., 2000).

Thirteen of the 35 adapted MC strategy questionnaire items significantly correlated with or predicted high from low GPA learners (Taraban et al., 2000). Yet, only three of the 35 MC questionnaire items significantly correlated with higher TASP-R test scores (Taraban et al., 2000). One significant weakness in this study was that Taraban et al.'s (2000) adapted questionnaire was not a standardized psychometric scale. Although Taraban et al. (2004) later further refined the 35-item MC questionnaire items into the 22-item MSRQ to assess college students' metacognitive reading strategies, the MSRQ did not correlate with standardized adult reading comprehension scores.

Among the studies summarized in Table 2, MC strategy use during academic reading did not consistently correlate with or predict higher RC among adult post-secondary learners (DeBoy, 1991; Little, 1999; Reid, 2013; Taraban et al., 2000, 2004). DeBoy's (1991) single group design was strengthened by the study's inclusion of two measures for each variable, RC and MC measured. Herrmann (1996) and Little (1999) explored the strength of relationships among the qualitative variables of MC interview response categories using descriptive narratives for interview responses; and quantitative variables of RC scores, and MC scores using univariate measures such as analysis of variance. The mixed methods study design limited data comparisons across groups (Herrmann, 1996; Little, 1999). None of these studies found significant positive correlations between higher academic reading comprehension scores and reported higher metacognitive strategy use.

The Table 2 studies focused on different aspects of the multi-dimensional concept of metacognition, such as self-judgment about one's RC level and MC strategy use.

These different aspects sometimes significantly correlated with higher RC, whether positively (DeBoy, 1991; Taraban et al., 2000), or negatively (Little, 1999; Taraban et al., 2000). Three of the six studies listed included a standardized RC measure, the RC measures were used in non-standardized ways, such as grouping participants for MC strategy training according to RC scores (Herrmann, 1996; Little, 1999), or as study inclusion criteria (Taraban et al., 2000). Only Taraban et al. (2000) and Taraban et al. (2004) included a standardized MC strategy measure specific to RC.

While Reid (2013) used a MC strategy awareness or knowledge measure, the MARSI, Reid did not include a standardized RC measure. DeBoy's (1991) MC strategy measure involved an adapted measure of awareness of cognitive strategies specific to RC. The MC measures used in these studies lacked a consistent MC definition, or a single MC theoretical framework, although concepts such as short-term memory, calibration, and executive thinking were often described as foundations for exploring MC strategy use with RC (DeBoy, 1991; Herrmann, 1996; Little, 1999; Reid, 2013; Taraban et al., 2000).

For example, critical thinking and executive functioning were concepts mentioned by Little (1999), yet only critical thinking was reported by Little (1999) from the group MSLQ-MC and cognitive subtest scores. Executive functioning was a MC concept that related to higher motivation as well as to better memory for RC (Herrmann, 1996). Taraban et al. (2000) also described memory as a cognitive aspect related to MC strategy use before, during, and after reading that reflected goal setting and evaluating specific to RC. Generally, the Table 2 studies lacked a universal definition or unifying framework of

MC specific to RC that reflected a complex interaction between cognitive, MC, and text factors.

Summary

This chapter reviewed literature that directly compared measures of reading comprehension and metacognitive strategy knowledge, awareness, and use for reading comprehension among adult learners. The six studies that explored reading comprehension and metacognitive strategy use among adult undergraduate learners enrolled in post-secondary programs within the United States of America were few compared to the literature on metacognitive strategies used for reading comprehension among children and adults learning to read in English as an additional language. Common process themes such as conscious and nonconscious or passive and active metacognitive strategy use during reading were described using two framework theories. Methodological weaknesses of the six selected studies were identified, such as a need for a theoretical framework of reading comprehension and metacognition, and processes of each framework that are believed to interact with each other. How these processes are activated and how they relate to enhance academic reading comprehension among native English-speaking adult learners in the United States of America will be explored through a quantitative study design described in the following Chapter 3.

Chapter 3: Research Method

The purpose of this study was to examine the relationship between self-reported metacognitive strategy use and reading comprehension among a sample of native English-speaking adults enrolled in a postsecondary program in the United States. The research question addressed the relationship strength between metacognitive strategy use during reading and reading comprehension among adult postsecondary learners. The research question, null hypothesis, and alternative hypothesis were as follows:

Research Question: Does metacognitive strategy use during reading relate to better reading comprehension among adult postsecondary learners?

H_o: The use of metacognitive strategies during reading, as reported by adult learners on the Metacognitive Awareness of Reading Strategies Inventory-Revised (MARSI-R) does not predict reading comprehension measured by scores on the Nelson Denny Reading Test (NDRT) Reading Comprehension subtest after controlling for the variable of vocabulary knowledge using the NDRT-Vocabulary subtest.

H_a: The use of metacognitive strategies during reading, as reported by adult learners on the Metacognitive Awareness of Reading Strategies Inventory-Revised (MARSI-R) is positively correlated with reading comprehension scores on the Nelson Denny Reading Test (NDRT) Reading Comprehension subtest after controlling for the variable of vocabulary knowledge using the NDRT-Vocabulary subtest.

This chapter presents the research methodology as originally approved by my committee and IRB. Changes to the study protocol were necessary due to the COVID-19 pandemic and are described in Chapter 4. The research methodology was based on a

single-sample quantitative design that allowed for the examination of metacognitive strategies used by a convenience sample of adult postsecondary learners when reading for comprehension. This chapter includes a description of the criteria for participant selection and study recruitment, as well as the standardized reading comprehension and metacognitive measures used in this study. The statistical analysis used, threats to the validity of the study, and limitations of interpretations of study findings are discussed in relation to the research question and methodology. The summary section of this chapter highlights the ethics, data collection, and data analyses related to the reported findings in Chapter 4.

Research Design and Approach

A quantitative approach including a single convenience sample for data collection and regression analysis was used. The research design was a nonexperimental cross-sectional study. In the context of this study, it was not feasible to provide any form of training or to experimentally manipulate any of the variables. In view of the study's aim of examining the relationship among quantitative variables without experimental manipulation of variables, a cross-sectional design was appropriate. Although some changes were necessary in the data collection protocol after the proposal was approved by IRB, the quantitative design was not changed.

Volunteer adult participants recruited from a regionally accredited postsecondary institution were to meet once with me in a group setting for data collection. Regression is a correlation-based analysis that allows for comparison of two or more continuous variables to determine the relationship strength between the variables (Grice & Iwasaki,

2007). The dependent variable of reading comprehension level was measured using the raw scores of the sum of the number of correct answers on the NDRT Reading Comprehension Form G subtest. Participant raw score sums were entered into data analysis and were not compared to the NDRT norms. Although changes to the instruments and data collection procedures were necessary subsequent to approval of the study proposal and IRB approval (as detailed in Chapter 4), no changes were made to the overall research design.

Publisher permission to alter the use of this standardized test for the purposes of this study (ProEd Inc., 1993) was obtained (see Appendix D). The control variable of vocabulary knowledge was included because previous research showed that it is related to better reading comprehension (see Brown et al., 1993; Norris, 2013; Rayner et al., 2011). Vocabulary knowledge was measured using the raw score sum of correct answers on the NDRT-Vocabulary subtest Form G. Publisher permission was obtained (see Appendix E) to use the standardized test for the purposes of this study (ProEd Inc., 1993). The NDRT was considered appropriate for this study because it was developed using criteria from adult academic learner educational experiences prior to attempts at norm reference criteria (see Brown et al., 1993; Mokhtari et al., 2018).

The independent variable of metacognitive strategy use was measured using the total score of the MARSI-R (Mokhtari et al., 2018). The MARSI-R (Mokhtari et al., 2018) and its prior MARSI versions (Mokhtari & Reichard, 2002; Sheorey & Mokhtari, 2001) were developed using criteria from peer-reviewed literature and adult learner norms. Demographic data of chronological age in years and the current number of years

enrolled in an undergraduate program were obtained from consenting participants, and were measured as raw scores for data entry with the other variables.

The NDRT's Reading Comprehension subtest and Vocabulary subtest were to be completed according to standardized administration, followed immediately by completion of the MARSI-R within an approximately 60-minute single session contact by college students who volunteered their time to participate in the study. The MARSI-R reflected the abbreviated form of its prior version. Recruitment of volunteers and maintenance of recruits for the single-session 1-hour study participation from a population of adult college learners with coursework and other time constraints due to adult life obligations was considered to be enhanced by compensation for the required volunteer time. Each consenting participant who returned the study packet at the session end was to be given a $10.00 gift card from the campus student union café in exchange for their session time. Modifications of some aspects of the recruiting are explained in Chapter 4.

Setting and Sample

Population

The target population was to be drawn from adult undergraduate learners attending college in a Midwest U.S. institution. Prospective participants attending the postsecondary institution who granted me access to participant recruitment and classroom use for the study tasks were to meet the inclusion criteria of being native English-speaking adult learners at least 18 years of age and enrolled in the publicly funded, land-based, postsecondary institution in the Midwest United States. Public postsecondary

institutions of learning in the United States represent diverse adult learners from across the country, particularly among large public universities that have approximately 15,000 to 30,000 students enrolled (Collegedata.com, 2013). I anticipated that the host campus would reflect a larger university or college and would best provide the opportunity for recruiting the necessary sample size for the study. Due to the COVID-19 pandemic, the population was broadened to include undergraduate learners over 18 years of age attending college within the Midwest and West United States.

Sampling Method

After my university provided approval for the data collection to begin, I was to approach up to five prospective host campuses through a letter of introduction (see Appendix E). Any consenting host campus would provide me confirmation of their IRB approval to recruit and meet with study participants on campus. A convenience sample of volunteer participants who met the inclusion criteria of attending the host university (being native English-speaking adult learners and at least 18 years old) would be recruited on campus. The host universities were to allow me access to campus bulletin board space and selected undergraduate classes for recruitment.

I was to present a 3-minute introduction to the study (see Appendix A). Access to prospective participants would occur through 3-minute classroom visits and bulletin board advertisements on campus (see Appendix A). The host campus was to provide me with a specified location for the data collection from consenting participants. This convenience sample of consenting participants would be asked to complete the study tasks of silent reading and written responses in a single group study session lasting

approximately 60 minutes. A recruitment incentive of collecting a $10.00 café gift card immediately after completing the study was initially planned to be given as compensation for a participant's study participation and time. As explained in Chapter 4, Survey Monkey hosted the survey online, recruited the sample, and collected the survey data as part of a business agreement partnership that allowed the partner to directly pay recruits who completed the online survey study. I did not provide study participants with any financial incentive.

Sample Size and Power Analysis

The web-based G*Power (Faul et al., 2013) was used to identify a minimum acceptable sample size ($N = 120$) at a power of 0.80 for examining the relationship between two variables while controlling for a third variable (vocabulary knowledge). The power level of 0.80 was considered sufficient to avoid making a Type II error of accepting the null hypothesis of no relationship when there was an actual relationship between the two variables of reading comprehension and metacognitive strategy use. The power of 0.80 to detect a statistically significant correlation of 0.25 between metacognitive strategy awareness use and reading comprehension scores was considered a conservative result based on the prior studies with inconsistent findings.

The 0.80 power level was considered sufficient to prevent a Type I error of rejecting the null hypothesis and accepting the alternative but incorrect hypothesis of a relationship between two variables, such as higher metacognitive strategy use and higher reading comprehension, when that relationship did not exist. If there were fewer than 120 participants in the study, this would decrease the study's power or validity of findings. If

there were fewer than 120 participants from the first week of study recruitment, I was to contact my committee to inform them of the need to approach a second prospective postsecondary institution in the region for permission to recruit adult undergraduate learners from their campus. The second postsecondary institution would be recruited following the same study protocol with my letter of introduction and IRB approval steps used when approaching the first postsecondary institution.

Instrumentation

In this section, I describe the instruments that were planned to be used in the study and the rationale for selecting them. In the context of the changes to the study protocol that were necessary due to COVID-19 health mandates, it was necessary to adapt the NDRT for use in an online survey. These adaptations are described in Chapter 4 and were done in a manner that was consistent with the permissions obtained from the test authors.

Nelson Denny Reading Test-Reading Comprehension Subtest

The NDRT Reading Comprehension subtest's high internal reliability was reported as 0.78 (95% C.I. 0.71 - 0.84; Brown et al., 1993). The NDRT's norms were not used for the purposes of this study. The NDRT was developed at Iowa State University using university postsecondary adult learners and graduates majoring in education during the mid-1900s (Brown et al., 1993). The NDRT Reading Comprehension subtest contains seven short narratives. Each narrative is followed by five multiple-choice questions about the narrative content that are answered in open book format. The sum of correct answers on these questions is compared to the test norms for reading comprehension levels (ProEd Inc., 1993). In the current study, raw scores of this subtest were used with the

permission of the publisher. Each participant's total raw score sum of correct answers on the NDRT Reading Comprehension Form G subtest was entered as data for analysis.

Each reading comprehension narrative contains five multiple-choice questions that provide a possible raw score of 0–5 for correct answers on the multiple-choice questions related to each of the seven narratives (ProEd Inc., 1993). The highest total score is 35 correct answers. The NDRT's Reading Comprehension Form G and H were recently replaced with a new test version Form I and J from norms obtained between the years 2013–2018 (ProEd Inc., 2019). Because little research had been published on the new test version, the old version was used for the current study. In more recent studies, researchers reported using the NDRT's Vocabulary subtest Version G and H and found that their undergraduate university student samples tended to score above the 1993 Vocabulary and Reading Comprehension subtest norm average (Coleman et al., 2010; Ready et al., 2013). I anticipated that the current study sample would also score within one standard deviation of the NDRT 1993 norms (ProEd Inc., 1993) given the copyrighted administration format and scoring for norm comparison.

Metacognitive Awareness of Reading Strategies Inventory-Revised

The MARSI-R is a standardized metacognitive (MC) strategy measure developed using factor analysis of the 30 MARSI items to produce 15 MARSI-R items with similar reliability and validity among adult university learners (Mokhtari et al., 2018). The MARSI-R samples were ethnically diverse similar to the adult postsecondary learners from the United States used for the MARSI sample norms (Mokhtari & Reichard, 2002; Sheorey & Mokhtari, 2001).

The MARSI development and the MARSI-R development did not include objective RC measures, only adult learner self-reported RC (Mokhtari et al., 2018; Sheorey & Mokhtari, 2001). The MARSI and MARSI-R authors acknowledged that their measure was not based on a specific theory of MC, and that cognitive factors such as memory that influenced RC were included in their MC strategy measure (Mokhtari et al., 2018; Mokhtari & Reichard, 2002; Sheorey & Mokhtari, 2001). A copy of the published MARSI-R measure is available in Appendix C.

The MARSI was created through factor analyses of cognitive and metacognitive strategies used for reading comprehension (Mokhtari & Reichard, 2002; Sheorey & Mokhtari, 2001). The MARSI-R was developed through standard and confirmatory factor analyses with the MARSI items, resulting in an overall MARSI-R internal reliability of 0.850 (Mokhtari et al., 2018). Reliability scores for each MARSI-R subscale were Global strategies scale at 0.703, Problem Solving strategies scale at 0.693, and Support strategies scale at 0.743 (Mokhtari et al., 2018).

Cronbach's alpha coefficient for the MARSI-R was 0.82 for Grade 12 graduates (Mokhtari et al., 2018). According to the MARSI-R items, metacognitive reading comprehension strategies involve readers' use of general and topic knowledge, as well as thinking strategies such as "Having a purpose in mind when I read," "Underlining or circling important information in the text," and "Adjusting my reading pace or speed based on what I am reading" (Mokhtari et al., 2018).

Readers rated their perceived mental effort or reading text demand with the use of such strategies on a five point scale where the number one reflects no awareness or use of

the strategy and five reflects awareness and consistent use of the strategy (Mokhtari et al., 2018). Mokhtari et al. (2018) found that ratings of 3.5 and higher per strategy reflected high strategy use among their samples of adult post-secondary learners, while ratings of 2.4 and lower per strategy reflected low strategy use among these learners. Readers reporting higher reading comprehension had significantly higher MARSI-R scores overall (Mokhtari et al., 2018).

The MARSI and MARSI-R Global subscale items are examples of MC strategy items related to the pre-reading phase, such as having a purpose or goal before beginning to read (Mokhtari et al., 2018; Sheorey & Mokhtari, 2001). MC strategies used during reading, such as slowing one's reading pace for better RC, or increasing reading speed for more familiar or text content judged less relevant to reading goals were included in the MARSI and MARSI-R Problem Solving subscale items (Mokhtari et al., 2018; Sheorey & Mokhtari, 2001). The MARSI MC strategies used during reading such as visualizing information read were not included in the MARSI-R, although pausing to think about the implications of reading content, and recognizing when text fit a reader's purpose remained on the MARSI-R (Mokhtari et al., 2018; Sheorey & Mokhtari, 2001).

The 15 MARSI-R metacognitive strategies listed are from the perspective of the reader's awareness of use during reading in order to comprehend text (Mokhtari et al., 2018). Each strategy is measured by a five-point Likert-type scale of reader awareness of the strategy they used during reading (Mokhtari et al., 2018). Scores for each item range from one to five on each of the three MARSI-R scales: Global, Support, or Problem

Solving. Each scale is summed then divided by the number of items (5) within that MARSI-R subscale.

This study used the total MARSI-R sum score for data entry and correlation with reading comprehension and vocabulary knowledge scores. Mokhtari and Reichard (2002) used the MARSI mean score categories to help readers identify personal areas of low strategy use in order to encourage readers to learn about these less familiar metacognitive strategies that can help their reading comprehension. However, the MARSI-R has yet to be measured in relation to scores on a standardized reading comprehension test and a control variable measure such as vocabulary knowledge among adult post-secondary learners study participants. Participants in the proposed study did not score their own MARSI-R forms and did not have access to their individual scores after completing their study participation. A copy of the MARSI-R is included in Appendix C of this proposal.

Nelson Denny Reading Test-Vocabulary Subtest

The NDRT Vocabulary subtest was developed from a criterion-based Iowa Teacher Certification test used at that time, and normed using adolescents from each high school grade level and adult university undergraduate students in the United States of America in the mid-1900s (Brown et al., 1993). The NDRT G and H version was recently replaced by a new version I and J with new norms obtained between the years 2013-2018 (ProEd Inc., 2019). Since little research has been published on the new test version, the old version will be discussed as part of this study's use.

More recent studies that reported using the Nelson Denny Reading Test's Vocabulary subtest version G and H found that their undergraduate university student

samples tended to score above the 1993 Vocabulary and Reading Comprehension subtest norms' average (Coleman et al., 2010; Ready et al., 2013).

The NDRT Vocabulary subtest presents academic words that post-secondary learners knew for the norming criteria of its test development described in Brown et al. (1993). Reliability was based on grade equivalencies of the combined reading comprehension and vocabulary subtests as presented in the reading comprehension subtest section above (ProEd Inc., 1993). Each academic word used as a NDRT Vocabulary subtest item is followed by a series of single words in multiple-choice format. Readers identified the closest word meaning match among five options as the best answer for that Vocabulary subtest item. Both the narrative and vocabulary word subtest sum scores were used for data entry and analysis.

The 80 NDRT Vocabulary subtest items were to be used to reflect vocabulary knowledge. The NDRT Vocabulary subtest word items each contained five choices for respondents to match word meanings with the subtest word item. The subtest word items progressively increased in difficulty. The raw number or sum of accurately defined words, with a possible raw score of 0 to 80 for each participant was entered for data analysis. Correct scores were to be indicated by participants' circling the correct multiple-choice option on each subtest item row. Correct answers reflected participant vocabulary knowledge used as the control variable in this study. Both NDRT subtests were to be completed following standard administration.

Data Collection

After the researcher's university provided approval for the data collection to begin, the researcher was to approach up to five prospective host campuses through a letter of introduction (see Appendix E). This letter requested access to adult students enrolled on campus for recruitment, and a campus location and time schedule for the researcher to meet with recruits who consented to participate and complete study tasks. When enough participants had completed the study tasks to meet the minimum sample size of 120 participants, the researcher was to remove the posted flyers and inform the host campus contact person about cancelling any remaining scheduled days and times for the study that may remain scheduled for that week.

A second potential host campus was to be approached if the first campus recruitment did not provide the necessary number of student participant to meet the study's minimum sample size of 120. The second prospective host campus was to be contacted only after the week of scheduled data collection days and times had expired on the first campus that provided consent to recruit study participants and complete the data collection on campus.

The host campus contact person, such as a program Dean or Director who provided the researcher with the host campus IRB letter of consent to recruit and complete the field study on campus was to be provided with a copy of the researcher's dissertation upon completion and approval of the dissertation. No identifying campus or participant information was available as part of the single group study results. The NDRT

publisher (ProEd Inc., 1993) was to be provided with a copy of the completed dissertation per the test use agreement between the publisher and researcher.

After the consenting host campus provided the researcher confirmation of their institutional review board approval to recruit and meet with study participants on campus, the researcher was to confirm with the host contact person access to prospective participants through undergraduate course rooms as assigned to the researcher by the host. The researcher was to make brief three-minute classroom visits to introduce the study, and place bulletin board advertisement on campus (Appendix A). Potential participants who arrived at the designated host campus study room on a scheduled day and time, and who consented to participate by signing their name on a consent form were to be asked to complete the study tasks. Recruits who did not meet study criteria or who chose not to participate or sign consent were to be asked to leave the study room at that time.

Recruits who agreed to participate were to have their consent forms taken by the researcher in exchange for a pre-coded study packet. Consent forms were to be kept locked in a case separate from the pre-coded raw data forms collected by the researcher upon participant completion of the raw data forms. The study tasks involved silent reading and written responses in a single group session lasting approximately 60 minutes. Each participant was to be provided with a pencil and pre-coded paper packet consisting of a demographic page, reading comprehension item pages, vocabulary subtest items pages, and a metacognitive measure page. When participants handed their packet to the researcher, the researcher was to hand each participant a $10.00 gift card before the

participant left the room. The $10.00 gift card incentive was deemed important compensation for participants obtained as a convenience sample for study participation.

Participant Recruitment

Adult volunteers who were native English language speakers enrolled in a public post-secondary undergraduate program in the mid-western United States of America were to be recruited from a land-based campus through campus bulletin board posts, and from undergraduate courses as allowed by the host university. The researcher was to spend three-minutes in each classroom as allowed by the host university to inform adult learners about the study. The researcher was to hand out to students the recruitment cards as depicted in Appendix A that listed the days, start times, and campus location of the study. Full disclosure of receipt of a $10.00 café gift card for students who completed the study tasks was stated on this card. Students interested in study participation were to keep a card and forward the other card copies to other students. Students who did not wish to participate or obtain a card copy for their consideration of study participation were to be asked to forward the card set to others in class. Card returns were to be collected by the researcher as the researcher left the classroom. The researcher was to also post cards on campus bulletin boards as allowed by the host campus for study recruitment.

Participant Consent

Potential volunteer participants who arrived at the campus study location during one of the scheduled days and times listed on the cards were to be informed of the study criteria and about their choice to consent to participate in the study. Study participation was voluntary and intended for adult learners enrolled in an undergraduate college credit

course at that campus. Participants were to be included in the study if they were native English-speakers, signed consent for study participation, and completed the study tasks of reading and metacognition reporting. Study participants were to expect to complete their study participation within approximately 60-minutes from the study start time.

The researcher was to ask potential participants who did not meet the study criteria of native English-speaking undergraduate adult learners enrolled on campus; as well as those who did not sign consent to participate or who elect to not participate in the study to leave before the timed study session began. Consenting participants were to be seated at tables or desks provided by the host campus in the study room for the silent reading and written response tasks of the study. The researcher was to verbally inform study participants that they could withdraw consent for study participation at any time during their participation. Consenting participants who did not complete all study tasks and remained for the entire session would have been excluded from study data analyses, yet receive the $10.00 café gift card upon turning in their packet upon leaving the study room. However, because Survey Monkey directly compensated survey participants, the researcher did not provide study participants with any financial incentive.

After the researcher collected all signed consent forms, the researcher was to lock these forms in a separate case from the study packets containing data for analysis. The researcher was to hand each participant a pencil or pen and a pre-coded packet of single sided pages. Participants were to be asked to read and answer by checking boxes on the first page containing demographic information of participant age (number of and

participant year in their campus program (first year, second year, or third or more year). The demographics page is provided in Appendix B.

The researcher was to direct participants to turn the page and listen to directions for the reading test to be completed within 20 minutes. Participants were to wait for further instructions if they finished before the time limit. The researcher was to then direct participants to complete the vocabulary subtest within the 15 minute time limit, and to wait for further instructions if participants finished before the time limit. The researcher was to then direct participants to complete the metacognitive measure and hand their packet to the researcher when this page was completed in exchange for the gift card. Participants were to circle a number rating from 1 to 5 representing their awareness and use of that specific strategy during today's readings for each of the 15 statements of the MARSI-R. A copy of the MARSI-R is provided in Appendix C.

Upon completion of the MARSI-R page, participants were to hand their packet to the researcher and take one $10.00 gift card in exchange for their study participation time. Participants interested in viewing the study results online were to keep the researcher's university contact information page that listed the researcher's web page on it for their future viewing after the study completion.

Because data collection had to be performed online due to the COVID-19 pandemic, participants gave their consent to participate in the study by indicating their willingness to do so in answer to a question at the beginning of the survey. As explained in Chapter 4, time limits for the various NDRT subtests could not be enforced in the context of an online survey through Survey Monkey. However, as explained in Chapter 4,

in cases where a participant did not complete the survey within an elapsed time duration that was deemed consistent with time limits for the NDRT subtests, that survey was not included in the data analysis. Details of the rationale and implementation of this procedure are given in Chapter 4.

Research Question and Hypotheses

Research Question: Does metacognitive strategy use during reading relate to better reading comprehension among adult post-secondary learners?

H_o: The use of metacognitive strategies during reading, as reported by adult learners on the metacognitive awareness of reading strategies inventory-revised (MARSI-R) does not predict reading comprehension measured by scores on the Nelson Denny Reading Test (NDRT) Reading Comprehension subtest after controlling for the variable of vocabulary knowledge using the NDRT-Vocabulary subtest.

H_a: The use of metacognitive strategies during reading, as reported by adult learners on the metacognitive awareness of reading strategies inventory-revised (MARSI-R) is positively correlated with reading comprehension scores on the Nelson Denny Reading Test (NDRT) Reading Comprehension subtest after controlling for the variable of vocabulary knowledge using the NDRT-Vocabulary subtest.

Data Analysis Plan

This section lays out the procedures for data analysis that were originally proposed and approved by my dissertation committee. Although the sampling procedures had to be changed due to the COVID-19 pandemic, the use of multiple regression analysis according to the approved data analysis plan was followed.

This correlational study explored the relationship between use of metacognitive strategies (independent variable [IV]) and reading comprehension (dependent variable [DV]) while controlling for vocabulary knowledge among undergraduates at American colleges. Multiple linear regression analysis was performed to investigate the research question and to decide whether to reject the null hypothesis. This statistical procedure was appropriate for the analysis of linear relationships between two sets of variables that are distributed on continuous scales (Gravetter & Wallnau, 2009).

Regression is a correlational analysis resulting in a regression model of estimation that scores on one or more independent variables will explain or predict scores on a single dependent variable (Gravetter & Wallnau, 2009). Linear regression analysis is based upon the assumption that the independent and dependent variables measured have a linear relationship (Chatterjee & Hadi, 2015; Ernst & Albers, 2017). The assumption of a linear relationship can be viewed using descriptive data such as a scatter plot of the dependent variable with each independent variable (Chatterjee & Hadi, 2015). Four other assumptions or criteria about study variables must be met to ensure the validity of regression analysis. These assumptions include equal residual variance or homoscedasticity, absence of multicollinearity, a normal distribution of residual errors relative to the prediction of the dependent variable, and the absence of outlier scores. The variance inflation factor (VIF) relates to a measure of tolerance or the amount of score variance not accounted for by the independent variables in the regression model and is a measure of multicollinearity. These results did not indicate extreme non-normality regarding any of the regression assumption measures. The validity of linear regression

results depends on the study data meeting these assumptions, which can be examined using scatter plots and diagnostic statistics from the regression analysis (Laerd Statistics, 2015).

Raw scores for each study variable collected for this study were entered and analyzed using IBM SPSS version 25 (SPSS Inc., 2014). Data from packets that were incompletely filled out by study participants were not to be used in the analysis. Metacognitive strategy use and vocabulary knowledge were included as predictor variables in this multivariate regression analysis; the dependent variable was reading comprehension scores. The standardized instruments used in the study were anticipated to maintain the least bias and most validity compared to less formal measures.

A regression coefficient represents the relationship between two variables while controlling for other variables, and identifies the best predictor for a constructed hypothesis (Gunver et al., 2018). For example, the correlation (p-value) of the proposed study's DV and IV reflected a relationship separate from a relationship with vocabulary knowledge, the control variable. The regression coefficient of the proposed study's DV and IV reflected the relationship between use of metacognitive strategies and reading comprehension, while controlling for vocabulary knowledge, the control variable. The p-value for the independent variable in the regression analysis was examined to test whether the metacognitive strategy use as an independent predictor of reading comprehension scores; a value of $p < .05$ was considered statistically significant. The semi-partial correlation coefficient for each independent variable in the model is a measure of its influence on the dependent variable while statistically controlling for the

other independent variable. Analysis results do not show causal relationships, only co-existing relations.

Threats to Validity

The use of standardized measures that were developed and normed on adult post-secondary learners, supported that results would reflect the constructs of each variable measured. Correlation does not demonstrate cause and effect dynamics between the variables measured. Correlation represents the strength of relationship among variables through the regression analysis. A stronger relationship between the frequency or type of MC strategy use with higher RC scores would indicate that the MC strategy use predicts higher RC.

Summing the number of strategies listed on the survey checklist was anticipated to help clarify or operationalize the concept of metacognition. The low error rates or ceiling effect reported in Ellis et al. (2009) due to the presence of familiar words to participants that were not challenging enough for university learners could also occur in the proposed study. This threat was addressed using a standardized reading test, the NDRT Reading Comprehension subtest and Vocabulary subtest Form G (ProEd Inc., 1993).

The study's internal validity was limited based on the use of volunteer study participants who may not represent a normal distribution of adult post-secondary readers for different reasons that the proposed study did not identify. Specific reading skill characteristics such as differences in personal reading experiences, motivation for reading in the study, and general word knowledge found to correlate with higher reading

comprehension in univariate measures could have compounded interpretations of the study results (Coleman et al., 2010; Ready et al., 2013). The use of a control variable in multivariate analysis was intended to reduce the impact of factors other than the dependent and independent variables measured for relational strength. Regression analysis also assumed that two or more variables were linearly related and that all scores would be distributed within a certain margin of error with no outlier scores or skewed data sets that reduced validity of findings.

Ethical Considerations

The ethical principles for protection of participants from potential harm due to study participation, payment for their participation time, and privacy of participants' personal information and data collected in a study were followed (American Psychological Association, 2017). Each participant was to be provided with a pre-coded packet that will only identify that the same anonymous participant completed all five pages of the reading study. There was no participant contact by the researcher after the participant completed the single study session. The signed consent forms for study participation were to be kept in a separate locked briefcase for transportation to a locking file cabinet in a locked office. All data was to be kept locked during analysis. Data was to be stored in a locked secure place for five years then shredded per university guidelines after study completion. There were no anticipated ill effects on participants from study recruitment, minimal financial compensation for their study session time, and anonymous participation.

The researcher secured university approval from both the researcher's university and the recruiting partner prior to beginning participant recruitment and data collection. Participants were to sign informed consent and would be free to leave the study at any time. The researcher maintained data security and participant confidentiality through the recruiting partner agreement.

Participants were requested in writing on the consent form to maintain a copy of the researcher's university information for reporting any concerns after their study participation. This university information page of the consent form was to list the researcher's web page that would present study results upon completion of the study and university approval of the dissertation report. The researcher would have no conflicting interests with the post-secondary institution that granted the researcher access to the campus for participant recruitment and the study's reading related tasks.

Summary

The proposed quantitative study explored the effects of the independent variable of metacognitive strategy use on the dependent variable of reading comprehension level given participants' level of vocabulary knowledge. Reading comprehension and metacognition have been viewed as interactive processes that occur before, during, and after reading in order to result in text comprehension. Some factors may influence or confound relationship results, as identified in prior univariate studies. For example, re-reading words and individual reader's higher vocabulary knowledge or education levels can result in a statistical positive skew for longer and progressively difficult word lists (Cowan, 2008; Erceg-Hurn & Mirosevich, 2008; Norris, 2013).

The use of a nonparametric statistical significance test such as regression analyses was still considered the most appropriate method of identifying strength of relationships among multiple dependent and independent variables. Study results and changes in protocols will be presented in Chapter 4 and discussed in Chapter 5 according to the conceptual frameworks and behavioral measures of metacognition discussed in Chapters 1 through 3 of this proposal.

Chapter 4: Results

The purpose of the quantitative study was to investigate whether greater self-reported metacognitive strategy use predicted better academic reading comprehension among a sample of undergraduate adult college learners. A single research question and hypothesis were tested using regression analyses. This chapter includes the results of these analyses and a description of participants sampled in this study regarding their age, number of years in the undergraduate program, and major field of study in that program.

Before presenting study results and sample characteristics in this chapter, I describe changes to the study protocol outlined in Chapter 3. Changes in the study protocol were approved by the my committee and by Walden University's IRB in June 2020 and again in October 2020 due to COVID-19 pandemic health mandates prohibiting in-person group gatherings beginning in March 2020. Many universities in the United States prohibited in-person student-led studies using enrolled students on their respective campuses beginning in April 2020.

Protocol Changes

Several changes had to be made to the protocol following initial IRB approval of the study so that participant recruitment and data collection could be conducted. Due to the COVID-19 health mandates that prohibited in-person meetings on campuses, the study was changed to an online protocol for participant recruitment, survey test taking, and data collection. Following the first IRB approval in fall 2019, I was not able to obtain a campus partner for recruitment. The second IRB approval in June 2020 allowed a recruiting partner (a regional campus coordinator) to email potential participants to

volunteer to complete an anonymous online reading study that contained the full NDRT and MARSI-R. This partnership resulted in one completed survey taking 45 minutes and eight incomplete surveys taking fewer than 20 minutes each, after 3 months. This first recruiting partner was replaced by an online partner, per IRB approval in September 2020. This online business agreement partner (Survey Monkey) recruited participants online and paid participants who completed the shortened adapted online reading survey.

Some changes to the study protocol were necessary, including adapting the survey to online data collection. The NDRT vocabulary and reading comprehension tests were shortened, per test publisher permission (see Appendix D). Two questions from the original protocol (participant age in years from 18 years old and up and the number of years enrolled in an undergraduate program from Year 1, Year 2, or Year 3 or more) were included to identify sample characteristics of the college or university adult learners. A third question (undergraduate program major or field of study) was included, per chair suggestion. The college major or program field of study question listed the categories of arts, sciences, business, and trades/technologies from which participants were asked to select one category that best described their current program of study.

Recruiting Partner

I selected Survey Monkey as the new recruiting partner based on the recruitment agreement that guaranteed the provision of data from the requested number of participants ($N = 120$) who completed the online reading survey. Survey Monkey guaranteed maintaining the data collection and participant anonymity as part of the recruitment agreement. The recruitment agreement with Survey Monkey included the

provision of survey data responses to me in Microsoft Excel or IBM SPSS format upon collection of the set number of completed surveys by participants matching the study participant criteria of being 18 years old or older, a current college learner, and a native English speaker. Consenting participants who completed the online reading survey were paid by Survey Monkey as part of its protected clientele agreement with their panelists who met specific criteria set out by survey developers. Although I had proposed to provide a $10.00 gift card in exchange for volunteer participant time during in-person group survey completion, compensation for participants' time was unnecessary and was removed for the online protocol.

Survey Adaptations

Survey Monkey required that the survey be limited to 50 questions and not include any consent document. The consent form counted as one of the 50 survey questions in the adapted short survey format. The full standardized version of the NDRT contains 35 reading comprehension questions with a subtest time limit of 20 minutes, and 80 vocabulary knowledge questions with a subtest time limit of 15 minutes. If the entire NDRT had been included in the online survey version, the online survey would have exceeded the limits imposed by the recruitment partner of 50 survey questions and 20-minute maximum survey completion time. Therefore, I shortened the online survey version, with approval from the publisher of the NDRT (see Appendix E), my committee, and the IRB. The online survey version of the MARSI-R remained unchanged from its original format and scoring for the shortened survey.

Adaptation of NDRT Vocabulary and Reading Comprehension Subtests

The test publisher granted permission to adapt the NDRT Form G (ProEd Inc., 1993) for the purpose of research (see Appendix D). The consent form, three participant characteristic questions, and 15 metacognitive reading strategy questions totaled 19 of the 50-question limit required by the recruiting partner. This resulted in 31 survey questions available for the reading test and metacognitive strategy questions.

Two of the NDRT's Form G (ProEd Inc., 1993) shortest narratives, each narrative containing five questions for a total of 10 questions from the standardized reading comprehension subtest, were selected for the adapted survey. This left a maximum of 21 online survey questions available for the vocabulary subtest questions.

The number of vocabulary items was reduced from 80 items in the full NDRT's Form G (ProEd Inc., 1993) to 20 items in the online survey used to collect data in the current study. A random list of 20 numbers from 1 to 80 was used to select the 20 online NDRT Vocabulary subtest questions from the full version of the test. The online survey reading comprehension and vocabulary questions were scored from zero reflecting no correct answers to one point for each correct answer. The maximum score for the online survey reading comprehension variable was 10 points. The maximum score for the online vocabulary knowledge variable was 20 points.

Survey Time Limits Imposed After Completion of Data Collection

Relatively few test takers were estimated to be able to complete the full standardized NDRT within the administrated time limit of 35 minutes. The anonymous online survey format of the shortened NDRT prevented me from observing participant

test-taking behavior and enforcing test completion time limits. I considered it necessary to determine a range of plausible completion times for the survey. Taking into account that the full NDRT was shortened to one fourth of the number of items and one fourth the time limits of the full NDRT for the online survey vocabulary and reading comprehension section, I eliminated survey responses when the completion times were outside of a plausible range.

One fourth of the 20-minute time limit for the full NDRT reading comprehension subtest standard administration translated to a 5-minute completion time for the online survey reading comprehension section. One fourth of the 15-minute time limit of the full NDRT vocabulary subtest standard administration translated to a 3.75-minute estimated completion time rounded up to 4 minutes of completion time for the online survey vocabulary section. These estimated online completion times for the reading test section of the survey totaled 9 minutes, which served as the basis for a maximum completion time for which a participant was estimated to reasonably read and answer the online survey reading test section questions. This 9-minute maximum online reading test time was summed with my estimates for online completion times of the other online survey sections.

For example, I estimated that reading and replying to the embedded consent form and three characteristics questions that immediately followed the consent form in the online survey took approximately 3 minutes. Completion of the 15 metacognitive strategy questions in the online survey was estimated to take 3 minutes. The 6 minutes completion time estimated for these two online survey sections was summed with the 9-minute

completion time estimated for the online reading test sections. The total maximum acceptable online survey completion time of 15 minutes seemed plausible and reasonable. Survey completion times longer than 15 minutes were then eliminated from the data set that was analyzed.

I anticipated that some study participants may be faster readers and may reply to survey questions more rapidly than the maximum estimated survey completion time of 15 minutes. Therefore, I considered that if some participants completed the reading test section 25% faster, these participants could complete the reading test section in 6.5 minutes rather than nine minutes. If faster readers spent only 1 minute instead of 3 minutes reading and answering the MARSI-R section questions and skipped reading the consent and instructions sections of the online survey, these readers could complete the online survey in 7.5 minutes, within half the estimated maximum online survey completion time.

I assumed that a 7.5-minute online survey completion time would be plausible and would likely reflect the reading comprehension of more skilled readers who spent only 4 seconds per MARSI-R item rather than 11 seconds per MARSI-R item to complete the MARSI-R within 1 minute. I considered online survey completion times faster than 7.5 minutes as less reliable or valid indicators of reading comprehension for this study's purpose. I included only survey completion times that ranged from 7.5 to 15 minutes in the data set that was analyzed.

Recruitment Results

The shortened online survey was sent out by the recruiter to over 5,000 potential participants who met the study criteria of being 18 years old or older, being enrolled in an undergraduate postsecondary program, and being a native English speaker within the Midwest United States for 1 week in October 2020. One hundred and twenty-nine recruits consented to participate and completed the online anonymous survey per the fall 2020 online business recruiting partner agreement. Survey completion times among this sample ranged from 46 seconds to 45 minutes. No participants were recruited under the original pre-COVID-19 protocol, and the one completed survey under the second approved protocol that allowed online adaptation of the survey's full reading test was not included in the data analysis.

Among the 129 survey responses obtained by Survey Monkey, 57 responses met the postdata collection criteria of survey completion times between 7.5 and 15 minutes. Three participants reported their age in years as 100 years old, which was significantly different from the group mean reported age in years. Other than these three participants' age scores, the remaining participants reported ages within the expected age categories of the study's proposed demographic page. Because the online survey did not have a default option for missing responses, the age scale responses of 100 years old were considered the survey default response. I included these three participants' scores in the regression analyses and counted their age as missing data for the descriptive statistics section.

Descriptive Statistics

The volunteer study participants ($N = 57$) reported their field of study and year in postsecondary program as part of the reading survey. Participants identified themselves in the number of years in undergraduate program and the program type or field of study. Table 3 contains the percentage and number of participants in each of these categories. Table 4 contains information on the mean scores and standard deviation from the mean for each study variable.

Table 3

*Demographics of Sample Characteristics (*N = *57)*

Characteristic	Frequency	Percentage
Field of study		
Arts	15	27.8%
Sciences	18	31.5%
Business	15	25.9%
Trades/technologies	9	14.8%
Years in program		
Year 1	22	38.6%
Year 2	14	24.6%
Year 3 or more	21	36.8%

Table 4

Descriptive Statistics of Study Sample's Scores

Study variable	*N*	Min. score	Max. score	Mean (*SD*)
Metacognitive strategy	57	15	75	57.82 (10.26)
Vocabulary knowledge	57	3	19	15.63 (3.25)
Reading comprehension	57	0	10	7.08 (2.75)

Note. Score ranges: 15-75 in metacognitive strategy, 0-20 in vocabulary knowledge, and 0-10 in reading comprehension.

Due to use of the adapted versions of the reading comprehension and vocabulary knowledge scales, Cronbach's alpha was conducted on each variable scale for a total scale score consistency measure. Cronbach's alpha, a measure of internal consistency, was examined for the adapted scales. A value of greater than .70 is satisfactory (Cronbach, 1951; Grande, 2014).

Cronbach's alpha for the 10-item reading comprehension scale was .828. This value was similar to the test publisher report of .78 for the test norms (see Brown et al., 1993). The 20-item vocabulary knowledge scale resulted in a Cronbach's alpha of .759. This value was difficult to compare to the test publisher reliability report because NDRT norms were available only for each grade equivalency year (ProEd Inc., 1993). The 15-item metacognitive strategy awareness scale resulted in a Cronbach's alpha of .875. This reliability statistic was similar to the high school graduate metacognitive strategy awareness score consistencies of .82 found in previous studies (see Mokhtari et al., 2018).

The reading comprehension scale scores ranged from a minimum of zero to a maximum of 10 points. The vocabulary knowledge scale scores ranged from a minimum of zero to a maximum of 20 points. The metacognitive awareness of reading comprehension strategies score ranged from a minimum of 15 points to a maximum of 75 points. Intercorrelations of study variables are listed in Table 5.

Table 5

Intercorrelations Between Metacognitive Strategy, Reading Comprehension, and Vocabulary Knowledge Scores

Variable	1	2	3
Metacognitive strategy	-		
Reading comprehension	.280	-	
Vocabulary knowledge	-.050	.550	-

Note. (N = 57) Constant, Vocabulary Knowledge. Predictor, Metacognitive.

Sig. (1-tailed) Vocabulary-Reading p = .001, Metacognitive-Reading p = .017.

Hypotheses

H_o: The use of metacognitive strategies during reading, as reported by adult learners on the metacognitive awareness of reading strategies inventory-revised (MARSI-R) does not predict reading comprehension measured by scores on the nelson Denny Reading Test (NDRT) Reading Comprehension subtest after controlling for the variable of vocabulary knowledge using the NDRT-Vocabulary subtest.

H_a: The use of metacognitive strategies during reading, as reported by adult learners on the metacognitive awareness of reading strategies inventory-revised (MARSI-R) is positively correlated with reading comprehension scores on the Nelson Denny Reading Test (NDRT) Reading Comprehension subtest after controlling for the variable of vocabulary knowledge using the NDRT-Vocabulary subtest.

Regression Analysis Assumptions

A linear regression analysis was conducted that examined the level of relationship among each independent variable of vocabulary knowledge scores and metacognitive reading strategy scores with the dependent variable of reading comprehension scores. The regression assumptions were met with the possible exception of the equal variance assumption.

As shown in Appendix F, the scatterplots of each independent variable with the dependent variable were consistent with the assumption of linearity. The first scatterplot for metacognitive strategy awareness and reading comprehension scores reflected few data points on the left side of the graph where the Loess Curve was horizontal compared to the right side of the graph where the Loess Curve slopes upward with the majority of data points. This upward slope given greater numbers of data points indicated that a straight line for regression or linear relationship may be assumed given a larger data set than the study sample provided. The second scatterplot of vocabulary knowledge scores with reading comprehension reflected acceptable linearity similar to the metacognitive strategy awareness scatter plot that reflected a horizontal line at the lower score or left section of the graph with an upward sloping line at the right section of the graph containing higher scores.

With regard, to the homoscedasticity assumption, a scatterplot of residual values versus predicted values, suggested that variance of the residuals was not constant across predicted values (See Appendix H). This scatterplot is diamond shaped, whereas if the homoscedasticity assumption were valid the scatterplot should be approximately

rectangular shaped, delineating an even band of points above and below the X-axis. Consequences of possible violation of the homoscedasticity assumption are discussed in Chapter 5. In regard to the normality assumption, the residual errors were approximately normally distributed in the histogram of the standardized residual scores. Also, the residual data points followed a straight line on the Q-Q Plot (see Appendix G), meeting the normality of the residuals assumption. Examination of the standardized residual error indicated that there were no outlier scores or points farther than three standard deviations from regression line. The statistical analysis, Cook's distance obtained from the regression analysis was within the 1.0 limit of bias measurement from the estimated regression coefficients. Cook's distance measure indicated that no scores or data points around the regression line unduly influenced the regression results. Such points of higher leverage or undue influence can distort the estimated regression slope coefficients for the independent variables (Laerd Statistics, 2015).

The regression assumption of absence of multicollinearity was met, as was indicated by the fact that the variance inflation factors (VIF) were less than 10, both for the independent variable of metacognitive strategy (VIF = 1.00) and for the control variable of vocabulary knowledge (VIF = 1.00). Absence of multicollinearity was also indicated by the fact that the study independent variables were not correlated with each other (r =-.050).

Regression Results

IBM SPSS V25 (SPSS, Inc., 2014) was used for data analysis for data coding and regression analysis. I entered the dependent variable of reading comprehension together

with the independent variable metacognitive strategy awareness, and the control variable of vocabulary knowledge into a linear regression analysis. The regression model showed that metacognitive strategy awareness scores significantly predicted reading comprehension. The null hypothesis of no relationship among the variables of reading comprehension and metacognitive reading strategy awareness was rejected.

The regression correlation coefficient squared ($R^2 = .398$) indicates that metacognitive reading strategy awareness and vocabulary knowledge explained 39.8% of the variance in this sample's reading comprehension scores. The square multiple regression correlation coefficient, R^2 tends to overestimate the true percentage of variance in the DV reading comprehension score explained by the IV metacognitive strategy awareness (Keith, 2019). The adjusted correlation coefficient squared ($R^2_{adj} = .376$), considered more accurate in estimating the true amount of variance in the DV was used to reflect reading comprehension score differences due to vocabulary knowledge and metacognitive strategy awareness scores.

Table 6 contains a summary of regression results. The regression results showed that metacognitive strategy awareness was a significant predictor of reading comprehension when vocabulary knowledge was controlled for. Metacognitive strategy awareness scores significantly predicted reading comprehension scores ($\beta = .309$, $p = .005$), and vocabulary knowledge scores largely predicted reading comprehension scores ($\beta = .566$, $p < .001$). Metacognitive strategy awareness was positively associated with reading comprehension in the model (ß=.309, p=.005). The semi-partial correlation coefficient for metacognitive strategy awareness (.308) squared is .094 or 9.4%, which

indicated that metacognitive strategy awareness was associated with 9.4% of the variance in reading comprehension scores after controlling for vocabulary knowledge. The model's adjusted R^2 (.376) indicated that both independent variables together explained 37.6% of reading comprehension score differences in this sample.

Higher metacognitive reading strategy awareness scores predicted higher reading comprehension scores after statistically controlling for the influence of vocabulary knowledge. Consequently, I rejected the null hypothesis of no relationship between metacognitive strategy awareness and reading comprehension. The alternative hypothesis of a positive relationship between metacognitive strategy awareness and reading comprehension, in which higher metacognitive strategy awareness scores significantly predicted higher reading comprehension scores was accepted.

Table 6

Regression Results of Metacognitive Strategy Awareness Predicting Reading Comprehension

Model	Unstandardized coefficients		Standardized coefficients	Semi-partial correlation		
	B	Std. Error	Beta		*T*	*P*
(Constant)	-5.212	2.232			-2.336	.023
Metacognitive Strategy	.083	.028	.309	.308	2.920	.005
Vocabulary Knowledge	.480	.090	.566	.565	5.352	<.001

Note. R^2=.398, R^2adj=.376, F (2,54) = 17.846, p = <.001, n = 57. Dependent Variable: Reading Comprehension. Predictors: (Control Variable) Vocabulary Knowledge, Metacognitive Strategy.

Summary

There was a significant positive relationship between metacognitive reading strategy awareness and reading comprehension when vocabulary knowledge scores were held constant or separate as influences on reading comprehension. Much of previous research has not controlled for vocabulary knowledge scores which has been shown to be correlated with reading comprehension. Chapter 5 will discuss the implications of this study's results.

Chapter 5: Discussion, Conclusions, and Recommendations

This quantitative study was designed to investigate whether self-reported metacognitive strategy awareness for use during reading was related to higher reading comprehension scores among a sample of undergraduate adult postsecondary learners. None of the six studies reviewed in Chapter 2 addressed direct measures of metacognitive reading strategy awareness and reading comprehension, which likely contributed to lack of significant associations. Results from the current study indicated a direct, moderate positive relationship between metacognitive reading strategy awareness and reading comprehension scores while controlling for vocabulary knowledge. These findings support that greater metacognitive reading strategy awareness exists with higher reading comprehension among the native English-speaking adult postsecondary learners in the study sample, in contrast to the six studies' findings that were reviewed for this study.

I used a quantitative design and two theoretical frameworks to select study variables and variable measures. One independent variable (metacognitive strategy awareness) and one control variable (vocabulary knowledge) were entered in regression analysis with the dependent variable (reading comprehension). Vocabulary knowledge that significantly correlated with reading comprehension (ProEd, 1993) measured differences in word recognition or knowledge activation in the regression analysis separate from the relationship between metacognitive strategy awareness reported by participants and reading comprehension scores.

Linear regression analysis indicated that higher metacognitive reading strategy awareness scores on the MARSI-R separate from vocabulary knowledge scores predicted

higher reading comprehension scores on the adapted NDRT scales of vocabulary knowledge and reading comprehension. This chapter includes interpretations of study findings within the context of study limitations, previous literature findings, and theoretical concepts related to study variables. I also present implications for future research, implications for positive social change, and recommended actions based on this study's findings.

Interpretation of the Findings

Empirical/Theoretical

The six studies reviewed in Chapter 2 included a standardized measure of metacognitive reading strategies with postsecondary adult reading comprehension but did not include a control variable such as vocabulary knowledge. The inclusion of vocabulary knowledge as a control variable in the current study helped clarify the influence of metacognitive reading strategy awareness and use on reading comprehension among this sample of postsecondary adult learners. The proposed inclusion of a complete standardized reading comprehension test using standardized administration for this study was anticipated to provide increased confidence in the study findings. However, the inclusion of a complete standardized reading comprehension test was changed to an adapted online reading test due to unforeseen and uncontrollable events related to COVID-19 school closures. Despite the adaptation, metacognitive reading strategy awareness scores moderately predicted reading comprehension scores.

The NDRT vocabulary knowledge and reading comprehension subtests were known to have a significant positive relationship (ProEd Inc., 1993). The Pearson

correlation between metacognitive reading strategy awareness and reading comprehension was not significantly correlated (r = .280). The Pearson correlation test for association between metacognitive reading strategy awareness and vocabulary knowledge measures was not statistically significant (r = -.050). These correlations confirmed that the independent variable measured different information than both the control variable of vocabulary knowledge and the dependent variable of reading comprehension.

The positive correlation found between metacognitive strategy awareness and reading comprehension scores aligned with the literature and theoretical frameworks purporting a positive relationship among these variables, despite previous researchers' findings of insignificant relationships between these two variables (see DeBoy, 1991; Efklides, 2008, 2014; Herrmann, 1996; Little, 1999; Reid, 2013; Taraban et al., 2000, 2004; Yeari & van den Broek, 2011). Current study results were consistent with previous findings among undergraduate postsecondary adult learners of higher self-reported metacognitive strategy use and higher self-reported reading comprehension (see Mokhtari & Reichard, 2002) or higher NDRT reading comprehension scores (see Coleman et al., 2010). Higher scores on both NDRT subtests of vocabulary knowledge and reading comprehension were consistently found among adult undergraduate postsecondary learners (Brown et al., 1993).

The two frameworks used for the foundation of the current study helped shape the definition and measurement of study variables (reading comprehension, vocabulary knowledge, and metacognitive reading strategy awareness). Neither the enriched model

of metacognition nor the landscape model of reading comprehension provided specific measures of their concepts (Efklides, 2008, 2014; Yeari & van den Broek, 2011). Both model frameworks alluded to reader processes that were either outside the reader's awareness or within the reader's awareness that may work together to aid reading comprehension (Efklides, 2008, 2014; Yeari & van den Broek, 2011). The NDRT and the MARSI-R selected for the current study separately measured study variables of reading comprehension and metacognition. The inclusion of a unifying theoretical framework such as the enriched model of metacognition also helped narrow the field of possible study variables most related to adult reading comprehension (Efklides, 2008, 2014).

Previous Study Methodologies

The six studies described in Chapter 2 addressed metacognitive reading strategies or metacognition related to reading comprehension without selecting a theoretical framework upon which to base interpretations of study findings. Lack of a direct positive relationship among metacognitive reading strategy awareness and reading comprehension in previous samples of postsecondary undergraduate adult learners was likely confounded by the presence of variables not identified or controlled statistically as an independent variable or control variable, such as different instruction methods for reading comprehension or metacognitive strategies not specific to reading comprehension (Herrmann, 1996; Little, 1999). Reid's (2013) study design and statistical comparisons of groups included a control group controlled without exposure to an instructional method of embedded cognitive, metacognitive, or both reading strategy questions in text comment boxes. Reid found no significant results but reported a positive trend for the

combined use of cognitive and metacognitive strategies among readers who answered more module reading content questions correctly. The other researchers found no significant relationship between previous reading comprehension scores on national standardized tests and current self-reported metacognitive strategy awareness or use (DeBoy, 1991; Taraban et al., 2000; Taraban et al., 2004).

Many previous studies of adult postsecondary learners' metacognitive strategies and reading comprehension included small sample sizes (Poissant, 1994; Williams et al., 2007). The division of sample sizes reported into smaller groups for some quantitative study designs also resulted in sample sizes that may have affected study power and findings (Reid, 2013; Taraban et al., 2000). Most previous studies reviewed for the current study measured children's reading comprehension score improvement over time with metacognitive strategy use drawn from class discussions (Cromley, 2005), or measured adult learner reading comprehension and metacognitive strategy awareness among native English-speaking adults in basic education classes within the United States or among adults learning English as an additional language within the United States or within postsecondary undergraduate education classes in countries other than the United States (Estacio, 2013; Taylor et al., 2011; Zhang & Sepho, 2013). The present study focused on native English-speaking postsecondary adult learners in the United States who attended postsecondary school within the Midwest and West United States.

The current study also limited the inclusion of study variables to two independent variables. One independent variable (vocabulary knowledge) had a significant positive relationship with better reading comprehension among adults (Hannon, 2012). The other

independent variable (metacognitive reading strategy awareness) had less consistent findings of a positive relationship with better reading comprehension despite strong theoretical support for a positive relationship with better reading comprehension (Cromley, 2005; Efklides, 2008, 2014; Flavell, 1979; Mokhtari & Reichard, 2002; Sheorey & Mokhtari, 2001; Taraban et al., 2000, 2004). Although the current study did not specify which model aspects, such as metacognition levels or reading comprehension strategies, were most frequently reported among the study sample participants, the findings supported the theoretical tenets that metacognitive reading strategy awareness had a positive, moderate relationship with academic reading comprehension.

Limitations of the Study

There were limitations that need to be acknowledged. The results indicated that even when vocabulary knowledge was controlled for, the adult undergraduate participants with higher reading comprehension also reported greater metacognitive reading strategy awareness and use. Linear regression provided a test of correlation only; cause and effect could not be assumed among this model's study variables. Correlation shows the presence of variables measured within a context such as a specific group defined by a researcher, based on selected characteristics to be measured (Chatterjee & Hadi, 2015). Regression statistics show the influence of predictor variables on a dependent variable (Chatterjee & Hadi, 2015).

Adapting and shortening the standardized NDRT limited the reliability of reading comprehension and vocabulary knowledge variables. Cronbach's alpha of .828 for the 10-item adapted reading comprehension scale compared favorably with the test publisher

report of .78 (see Brown et al., 1993). The 20-item vocabulary knowledge scale Cronbach's alpha of .759 for the current study was difficult to compare with the NDRT vocabulary subtest reliability scores that differed for each postsecondary year in the sample norms (see Brown et al., 1993). However, the value of Cronbach's alpha was considered to be satisfactory.

The use of an adapted version of the full NDRT that was shortened to meet survey partner criteria for online recruiting and participant anonymity might have reduced construct validity of the reading comprehension and vocabulary knowledge variables measured. This survey format change prevented me from monitoring survey completion times and ensuring that all participants read the survey instructions. This required assumptions to be made regarding minimum and maximum survey completion times; data for those who did not meet the time assumptions were limited. Although the assumptions were reasonable, it is possible that some data were eliminated that should not have been (or vice versa).

It is possible that weaker readers among those recruited may have declined to participate and only more confident or skilled readers elected to participate. Although previous study designs and methodology differences make it difficult to compare previous findings to the current study, the inclusion of a standardized metacognitive reading strategy awareness measure and a control variable significantly correlated with reading comprehension helped clarify significant study variable relationships.

The study's use of volunteer participants rather than randomly selecting participants drawn from the larger population of adults who met study criteria prevented

generalizing this study's results to other adult postsecondary learner samples or the general population of adult learners. A smaller sample size ($N = 57$) than the anticipated sample size ($N = 120$) for acceptable statistical power resulted due to the high number of response times not anticipated to be significantly faster than the 7.5-minute minimum time needed to complete the survey. This sample size compared to group sizes ranging between 20 and 50 participants in four of the six studies reviewed for this study (see Herrmann, 1996; Little, 1999; Reid, 2013; Taraban et al., 2000). Little (1999) and Reid (2013) used control groups against which to measure differences between other groups' reading comprehension scores post interventions, while Herrmann (1996) used a pre- and postreading comprehension test as a measure of change due to metacognitive strategy score differences reported by individual participants. I used a control variable (vocabulary knowledge), which helped identify the moderate effect size of the independent variable (metacognitive strategy awareness) on reading comprehension scores.

The fewer numbers of adult learners enrolled in their second year of undergraduate studies compared to the higher numbers of adult learners reportedly enrolled in their first or third or more year of undergraduate studies within this sample aligned with previous reports of concerns about first-year undergraduate learner dropout rates in the United States (Bidwell, 2014; Camera, 2016; Juszkiewicz, 2017). Characteristics of this study's sample, such as fewer second year participants compared to first and third year participants may not be reflected in other groups of adult postsecondary learners. This study did not explore reasons for the relatively fewer second

year participants compared to first and third year participants. This sample characteristic may or may not relate to concerns that low reading comprehension is one of the many reasons cited as a cause for undergraduate learners to leave their undergraduate program after their first year of enrollment (Gates, 2017).

My statistical interpretation of the regression analysis results may have been affected by a possible violation of the homoscedasticity assumption. As noted in Chapter 4, the variability in the residual errors from the regression model was not constant for all predicted values, as would be expected under the homoscedasticity assumption. Instead, variability was highest in the middle range of the predicted values and lowest at the extremes. As a result, the scatterplot of the residuals versus the predictor values had a diamond shape (see Appendix H). However, this specific type of pattern of violation of homoscedasticity tends to result in standard errors that are too large, and consequently leads to larger *p* values (Darlington & Hayes, 2017). Therefore, it is unlikely that violation of the homoscedasticity could have biased the regression results in favor of making metacognitive strategy use statistically significant as a predictor of reading comprehension. From this perspective, the regression results are conservative.

Recommendations for Future Research

More information is needed from undergraduate postsecondary learners who report higher metacognitive strategy awareness use to aid academic reading comprehension, particularly among first-year undergraduate learners. Future research methodologies would ideally include standardized measures of adult reading comprehension, vocabulary knowledge, and metacognitive reading strategy use during

the study's academic reading comprehension activities. A future researcher may explore the validity of these findings using other adult postsecondary undergraduate learner samples and additional standardized measures to explore a potential causal or indirect interaction effect involving lower order and higher order metacognitive processes on reading comprehension scores. Future online surveys may include technology that can enforce time limits for reading comprehension and vocabulary sections of reading studies related to metacognitive strategy awareness and use for academic reading.

I did not investigate how the study participants gained their metacognitive reading strategy knowledge or selected their metacognitive reading strategies when reading for comprehension. It also remains to be seen whether findings would be consistent with studies of other native English-speaking adult postsecondary learners. Future study findings providing answers to questions such as these may inform instructional practice for reading comprehension among native English-speaking adult postsecondary learners. This practice could increase the academic success of these learners and increase timely program completion rates in the United States, cited by some as an urgent need for many undergraduate postsecondary learners (Bidwell, 2014; Brunswick, 2015; Camera, 2016; Gates, 2017; Juszkiewicz, 2017). Also, reading comprehension remains a necessary prerequisite for many jobs and job training programs in the United States (Austin Police Department, 2013; Molloy College, 2014).

Future research could focus on first-year undergraduate post-secondary learners transitioning from high school to university who may be at risk for program non-completion. Learners who are at-risk of program non-completion may be defined by

learners in the lowest grade point average quartile upon program entry, minority status, a history of remedial coursework, indecision on a declared major, or unclear graduation to work plan may be compared to the other quartile learner groups entering the undergraduate program. I did not measure possible COVID-19 impacts on participants' metacognitive strategy awareness or reading comprehension scores. A future researcher might explore the metacognitive strategies related to possible COVID-19 effects on the metacognitive reading strategies reported by adult undergraduate post-secondary learners, particularly learners with lower reading comprehension.

Even when participants report their metacognitive knowledge or declarative knowledge about their reading comprehension strategies as strong, as reported by most participants of this study, does this self-report result from continued development of metacognition based on social, lifespan, or academic experiences related to reading workload or text difficulty increases? Further exploration of metacognition development applied to reading comprehension may identify whether or not metacognitive reading strategies develop less rapidly or effectively with or without specific intervention experiences such as feedback or direct instruction. A future researcher may find more objective measures and ways to explore Efklides's (2008, 2014) concepts such as nonconscious metacognitive processes and the interaction of such concepts across levels of metacognition.

I did not control for possible confounds such as memory score differences that could explain the relationship between reading comprehension or metacognitive strategy awareness scores (Van Dyke et al., 2014). Other possible confounds may include parent

educational level, English as an additional language spoken by a learners' parents, learner minority status, learners who are single parents or family caregivers, learners who work full time or part-time, and learner low socioeconomic status in the U.S., all of which could affect the relationship between metacognitive reading strategy awareness and reading comprehension, as well as indirectly impact adult learner program completion (Gates, 2017; Juszkiewicz, 2017).

A theoretical framework, such as the enriched model of metacognition (Efklides, 2008, 2014) and standardized measures could provide the foundation to explore a potential causal or indirect interaction effect involving both lower order and higher order metacognitive processes on reading comprehension scores. Objective measures of other theoretical concepts, such as metacognitive knowledge and awareness related to reading comprehension that results from: direct in-class instruction (Amzil, 2014; Williams et al., 2007), socially mediated learning outside the classroom as indicated by the enriched model of metacognition (Efklides, 2008, 2014), or greater number of years in formal education (Mokhtari et al., 2018; Mokhtari & Reichard, 2002) are needed. Future research may include participant reading comprehension failure during a reading task using a time series research design that measures specific metacognitive strategies used before, during, and after reading a selected text section Qualitative research may explore how to measure metacognitive strategies control strategies, such as planning and learning related to reading comprehension within specific contexts. For example, how does socially shared knowledge through exposure to others' judgments or feedback during one

or more shared class experiences impact learning or decision making specific to reading comprehension, as described in Efklides (2014)?

Qualitative methodologies may involve participant self-report measures of emerging awareness about one's judgments or feelings about text content, as well as one's reading comprehension measured at set times or text sections. Participant self-reports may include metacognitive reading strategies used to construct or interpret text meaning. A future researcher may investigate how to empirically measure the application of reading comprehension concepts such as Yeari and van den Broek's (2011) standard of coherence to specific MARSI-R metacognitive reading strategies such as, reading back and forth in text, and predicting text meaning used among adults with higher reading comprehension scores.

A researcher could use a mixed qualitative-quantitative study to measure participant eye movement through an on-screen tracking device, while the participant reads text and reports aloud their strategy selection or reason for a strategy change. The highest standard of a double-blind experimental research design using randomly selected study participants who are randomly assigned to a treatment strategy and who are measured before and after exposure to intervention is difficult to establish when study variables are abstract concepts with few or no standardized measures. A double-blind experimental research design that involves both participants and persons administering reading interventions remaining unaware of whether or not they are in the experimental or control group may be ideal although may not be feasible in an adult education research setting.

This study's results supported the large influence of vocabulary knowledge scores on reading comprehension scores that occurred separate from the moderate influence of metacognitive reading strategy awareness scores on reading comprehension scores, and indicated a possible mediating role of vocabulary knowledge to explore in future research on metacognitive strategy awareness and reading comprehension. This finding indicates the potential for identifying a causal indirect relationship between metacognitive reading strategy awareness and reading comprehension.

Because social and cognitive-based strategy feedback improved reading comprehension (van den Broek & Espin, 2012) and was theorized by Efklides (2014) to improve metacognition development, exploring the effect of specific feedback type on metacognitive aspects such as increased metacognitive awareness and control of one's thinking before, during, and after reading could identify effective metacognitive teaching strategies for adult learners.

The landscape model does not include metacognition as an aspect of its reading comprehension model, although the model describes text information processing concepts such as bridging or cycles of looking back and forward in text similar to metacognition concepts of reciprocal feedback across levels of metacognition as described in the enriched model of metacognition (Efklides, 2014; Yeari & van den Broek, 2011). Both models support the existence of processes outside the awareness of the reader with strategic reader processes that reflect lower-order and higher-order cognitive and metacognitive processes working together to produce reading comprehension.

The landscape model of reading comprehension describes how passive or automatic processes such as short-term memory during reading are outside of a reader's awareness until reading comprehension fails (Rapp et al., 2007; van den Broek & Espin, 2012; Yeari & van den Broek, 2011). This reading comprehension failure activates strategic cognitive processes such as rereading text that interact with passive processes in cycles to produce higher-order thinking such as interpreting, inferencing, and anticipating future use of text content that aids reading comprehension (Yeari & van den Broek, 2011). A future researcher may find ways to measure the interaction of these processes believed to occur through concepts such as bridging, and reader-created standards of coherence for interpreting or creating text meaning (Yeari & van den Broek, 2011).

For example, vocabulary knowledge scores in this study could relate to the concept of bridging used during reading for comprehension. The concept of a reader-created standard of coherence may align with specific metacognitive reading comprehension strategies reported in this study. Aligning specific reading comprehension strategies reported by readers with the highest reading comprehension scores may reflect a standard of coherence that is more effective than another standard of coherence.

The enriched model of metacognition describes reading comprehension as the result of a reciprocal relationship across levels of metacognition or metacognitive processes, such as metacognitive judgments and experiences in social contexts, declarative metacognitive knowledge or skills, and metacognitive monitoring involving hypothesizing about future use of text information (Efklides, 2008, 2014). A future researcher may find ways to measure how these three metacognition levels interact in

cyclical phases of planning, activating, monitoring, controlling, and reflecting on oneself behaviors, feelings, and learning in specific contexts (Efklides, 2014). A future researcher may also explore how these metacognition processes provide feedback that activates emerging reader awareness or interpretation of text meaning. For example what metacognitive feedback, such as reader understanding of past and current texts signals reading comprehension failure or emergence (see Efklides, 2008, 2014)?

Specific MARSI-R items such as reading back and forth in text or seeing that text matches a reader's purpose and predicting text meaning may predict better reading comprehension scores may be compared to or aligned with other metacognition processes, such as judgments about a text before, during, and after reading. The nonconscious socially shared knowledge and judgments may be most pertinent to recent education experiences affected by COVID-19 restrictions that reduced shared learner campus time and increased the effects of the socially shared experience of physical distance or isolation mandates. Metacognitive judgments about one's ability or performance specific to a task such as reading comprehension may be affected by the amount of time a reader engages in socially shared reading, academic discourse, and study experiences.

The moderate relationship among self-reported metacognitive strategy awareness and reading comprehension scores that I found in this study aligned with the premise of the enriched model of metacognition specific to reading comprehension (Efklides, 2014). Both the landscape model and the enriched model of metacognition supported a multidimensional view of reading comprehension, as a phenomenon resulting from the

function of lower order processes such as memory for text and selecting reading strategies, with higher-order processes such as, hypothesizing about or interpreting text meaning. The models differed in that the landscape model did not address how metacognition impacted or activated and reading comprehension or reading strategies, while the enriched model of metacognition focused on the aspects of activating reading comprehension and metacognitive reading strategy use.

Implications

My finding that greater metacognitive reading strategy awareness predicted better reading comprehension scores among this study's participants may indicate greater potential for post-secondary program completion rates, greater income earning potential, and greater potential for social participation (Afdaleni, 2013; Bidwell, 2014; Gates, 2017; Zhang & Sepho, 2013). Metacognitive reading strategy awareness that can increase individual learner reading comprehension may also reduce learner stress while in school. This may lead to better program completion rates or higher graduation rates among postsecondary learners. Program completions may in turn increase socio-economic gains over a learner's lifetime that results in better physical health and social self-agency.

The inclusion of metacognitive strategy instruction to increase reading comprehension at the public institution level such as schools and workplaces also has the potential to provide a similar decrease in stress with increased self-agency and income earning potential beyond the personal level of change. Parents who use metacognitive reading strategy skills are more likely to demonstrate or teach their children such skills at home. Metacognitive reading strategies engaged before, during, and after reading for

comprehension have the potential to guide more constructive dialogue about reading content through critical thinking and anticipating consequences of the application of reading content in actions or speech. Future quantitative research using more stringent methodologies, such as random sample selection and group comparisons is needed to identify specific metacognitive reading strategies most effective for adult postsecondary learners' reading comprehension.

Recommended Actions

Some studies found no relationship among these variables due to using definitions and measures of metacognitive strategies that were not directly related to reading comprehension but related to learning (Herrmann, 1996; Little, 1999). The acceptance of a standard definition and measure of theoretical concepts, such as metacognitive reading strategies and reading comprehension is considered the first step in informing adult learners and adult learner instructors about how to increase reading comprehension among adult post-secondary learners. This first step may include the use of two or more adult learner samples randomly selected to increase confidence in study results that may apply to other similar samples in an identified population of learners.

The use of a participant recruiting partner can increase the chances of obtaining larger sample sizes and greater learner diversity for group comparisons, such as learner characteristics of program type, life or work experiences, or years in an undergraduate program. Instructors can explore the effectiveness of vocabulary instruction before on in conjunction with instruction in expected text organization and culture based ethics within a specific field of study or workplace.

Cross-cultural studies can explore universally accepted definitions and measures of metacognitive reading strategies and reading comprehension based on culture and language, or field of study terminologies and logic that learners experience in technical or humanities-based academic programs. Considering adults as learners developing across the lifespan may involve educating learners and instructors about recognizing social bias through accurately assessing individuals' social experiences and feedback received in key social contexts related to academic experiences.

Conclusion

Findings from this study's literature review identified weak alignment between theoretical frameworks, concepts, measures, and research methodologies when investigating metacognitive reading strategy awareness and reading comprehension variables. The results of this study and literature review helped bridge the needed theoretical framework and concepts upon which to base a quantitative research design. The standardized measures selected for the study variables served as a basis to inform practical applications of some framework concepts. A moderate positive relationship between metacognitive reading strategy awareness and reading comprehension resulted separately from the large positive relationship among vocabulary knowledge and reading comprehension scores in this study's sample of volunteer participants.

This study's findings indicated the ongoing metacognitive development of adult learners throughout the undergraduate program years that may relate to reading comprehension and continued learner development beyond the first and second years of program enrollment. This study's participant demographics reflected learners who

volunteered to complete an online reading survey who were just as likely to be older learners, as they were younger learners. These demographics may reflect the changing education, employment, and social settings of recent months related to job retraining, as well as job training needs of a larger group of adult learners who were not study participants.

References

Afdaleni. (2013). Language learning strategy in English reading comprehension used by successful and unsuccessful learners at college. *International Review of Social Sciences and Humanities*, *5*(2), 193–202.

American Psychological Association. (2017). *Psychologists code of ethics.* Author. Washington, D. C. https://www.apa.org/ethics/code

Amzil, A. (2014). The effect of a metacognitive intervention on college students' reading performance and metacognitive skills. *Journal of Educational and Developmental Psychology, 4*(1), 27-45. https://pdfs.semanticscholar.org/8909/815544dfdeb87222d794f81184a98fa9921d.pdf

Andrews, S., & Hersch, J. (2010). Lexical precision in skilled readers: Individual differences in masked neighbor priming. *Journal of Experimental Psychology: General*, *39*(2), 299–318. https://doi.org/10.1037/a0018366

Austin Police Department. (2013). *Nelson Denny Reading Comprehension and Vocabulary Test*. https://www.yumpu.com/en/document/view/48592824/nelson-denny-reading-test

Baker, L. (1989). Metacognition, comprehension monitoring, and the adult reader. *Educational Psychology Review*, *1*, 3–38. https://doi.org/10.1007/BF01326548

Bidwell, A. (2014). July 3. How to fix America's college remediation issue. *U.S. News and World Report*. https://www.usnews.com/news/articles/2014/07/03/schools-and-colleges-still-struggle-to-reduce-the-need-for-remedial-education

Brown, J. I., Hanna, G. S., & Fishco, V. V. (1993). *Nelson Denny Reading Test Technical Report*. ProEd Inc. https://www.proedinc.com/Products/13261/ndrt-nelsondenny-reading-test-technical-report.aspx

Brunswick, N. (2015). Metacognition and reading: Comparing three forms of metacognition in normally developing readers and readers with dyslexia. *Dyslexia*, *21*(3), 273–284. https://doi.org/10.1002/dys.1501

Buchweitz, A., Mason, R. A., Tomitch, L. M. B., & Just, M. A. (2009). Brain activation for reading and listening comprehension: An FMRI study of modality effects and individual differences in language comprehension. *Psychology and Neuroscience*, *2*(2), 111–123. https://doi.org/10.3922/j.psns.2009.2.003

Camera, L. (2016). April 27. High school seniors aren't college ready. *U.S. News and World Report*. https://www.usnews.com/news/articles/2016-04-27/high-school-seniors-arent-college-ready-naep-data-show

Chatterjee, S., & Hadi, A. S. (2015). *Regression analysis by example (Fifth edition)*. John Wiley & Sons, Inc. https://doi.org/10.1111/insr.12020_2

Coleman, C., Lindstrom, J., Nelson, J., Lindstrom, W., & Gregg, K. N. (2010). Passageless comprehension on the Nelson-Denny Reading Test: Well above chance for university students. *Journal of Learning Disabilities, 43*(3), 244-9. https://doi.org/10.1177/0022219409345017

Collegedata.com. (2013). *Student body size: Small, medium or large?* 1st Financial Bank USA. https://www.collegedata.com/content/content_printarticle_tmpl.jhtml?articleId=1

0006

Conners State College. (2019). *Nelson Denny Reading Test (NDRT) frequently asked questions.* Author. Warner, Oklahoma. http://connorsstate.edu/nursing/ndrt/

Cowan, N. (2008). What are the differences between long-term, short-term, and working memory? *Progressive Brain Research*, *169*, 323-338. PubMed Database. PMID: PMIC2657600

Cromley, J. G. (2005). Metacognition, cognitive strategy instruction, and reading in adult literacy. *Review of Adult Learning and* Literacy, *5*(7), 187-205. https://pdfs.semanticscholar.org/5bfc/8b40d392c8b810755b4c97d0f308e76ce3a8.pdf

Cronbach, L. F. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, *16*(3), 297-3--. http://psych.colorado.edu/~carey/courses/psyc5112/readings/alpha_cronbach.pdf

Cubukcu, F. (2008). Enhancing vocabulary development and reading comprehension through metacognitive strategies. *Issues in Educational Research*, *18*(1), 1-11. www.iier.org.au/iier18/cubukcu.pdf

Darlington, R. B., & Hayes, A. F. (2017). Regression analysis and linear models: Concepts, applications, and implementation. Guildford Press.

DeBoy, J. L. (1991). *Metacognitive knowledge and reading comprehension: Similarities and differences of at-risk and successful college students*. Dissertation. ProOuest and University of Michigan No. 9206309.

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135-68. https://doi.org/10.1146/annurev-pscyh-113011-143750

Dubois, J., Hamker, F. H., & VanRullen, R. (2009). Attentional selection of noncontiguous locations: The spotlight is only transiently "split". *Journal of Vision, 9*(5), article 3 online. http://www.journalofvision.org/9/5/3.full

Efklides, A. (2006). Metacognition and affect: What can metacognitive experiences tell us about the learning process? *Educational Research Review*, *1*, 3-14.

Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. *European Psychologist, 13*, 277–87. https://doi.org/10.1027/1016-9040.13.4.277

Efklides, A. (2011). Interactions of metacognition with motivation and affect in self-regulated learning: The MASRL model. *Educational Psychologist, 46,* 6–25. https://doi.org/10.1080/00461520.2011.538645

Efklides, A. (2014). How does metacognition contribute to the regulation of learning? An integrative approach. *Psychological Topics*, *23*(1), 1-30. https://www.researchgate.net/publication/279900448_How_Does_Metacognition_Contribute_to_the_Regulation_of_Learning_An_Integrative_Approach/

Ellis, A. K., Denton, D. W., & Bond, J. B. (2013). An analysis of research on metacognitive teaching strategies. *Procedia Social and Behavioral Sciences*, *116*, 4015-4024. https://doi.org/10.1016/j.sbspro.2014.01.883

Ellis, A. W., Ferreira, R., Cathles-Hagan, P., Holt, K., Jarvis, L., & Barca, L. (2009). Word learning and the cerebral hemispheres: from serial to parallel processing of

written words. *Philosophical Transactions of The Royal Society of Biological Sciences*, *364*(1536): 3675-36096. PubMed Database. https://doi.org/10.1098/rstb.2009.0187

Erceg-Hurn, D. M., & Mirosevich, V. M. (2008). Modern robust statistical methods: An easy way to maximize the accuracy and power of your research. *American Psychologist*, *63*(7), 591-601. https://doi.org/10.1037/0003-066X.63.7.591

Ernst, A. F., & Albers, C. J. (2017). Regression assumptions in clinical psychology research practice – a systematic review of common misconceptions. *Peer Journal*, (*5*)e3323. https://doi.org/10.7717/peerj.3323

Estacio, J. M. (2013). Bilingual readers' metacognitive strategies as predictors of reading comprehension. *Philippine ESL Journal*, *10*, 179-199. Time Taylor International. ISSN: 1717-2298.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2013). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149-1160. http://www.gpower.hhu.de/

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist*, *34*(10), 906-911. https://doi.org/0003-066X/79/3410-0906$00.75

Gates, B. (October 2, 2017). *Putting students first.* Author. Atlanta, Georgia. https://www.gatesnotes.com/Education/Georgia-State-University

Garden City Community College. (n.d.). *Mission Statement*. Author. Garden City, Kansas. https://www.gcccks.edu/admission/assessment/nelson.aspx

Goodman, N., & Johnson, E. (2011). December 15. *Academic achievement assessment: Reading fluency*. Department of Education. Boise, ID. https://idahotc.com/Portals/23/Docs/Archived%20training/AA_Reading%20Fluency.pdf

Grande, T. (2014). Calculating and interpreting cronbach's alpha using spss. Video. https://www.youtube.com/watch?v=kz80dR6Jv44

Gravetter, F. J., & Wallnau, L. B. (2009). Statistics for the behavioral sciences. Belmont, CA: Wadsworth Publishers. ISBN 9780495602200.

Grice, J. W., & Iwasaki, M. (2007). A truly multivariate approach to MANOVA. *Applied Multivariate Research*, *12*(3), 199-226. Author. http://psychology.okstate.edu/faculty/jgrice/personalitylab/Grice_Iwasaki_AMR.pdf

Gunver, M., Senocak, M., & Vehid, S. (2018). To determine skewness, mean and deviation with a new approach on continuous data. *PONTE International Scientific Research Journal*, *74*. https://doi.org/10.21506/j.ponte.2018.2.5

Hannon, B. (2012). Understanding the relative contributions of lower-level word processes, higher-level processes, and working memory to reading comprehension performance in proficient adult readers. *Reading Research Quarterly*, *47*(2), 125–152.

Herrmann, S. P. (1996). *Cognitive, metacognitive and motivational variables as determinants of learning from text.* Dissertation. University of Houston, Houston, Texas. Dissertation Abstracts Search through University of Michigan online.

Juszkiewicz, J. (2017). November. *Trends in community college enrollment and completion data 2017.* Washington, D.C.: American Association of Community Colleges. https://www.aacc.nche.edu/wpcontent/uploads/2018/04/CCEnrollment2017.pdf

Keith, T. Z. (2019). Multiple Regression and Beyond: An Introduction to Multiple Regression and Structural Equation Modeling (3rd ed.). NY: Routledge. https://doi.org/10.4324/9781315162348

Kendeou, P., & van den Broek, P. (2007). The effects of prior knowledge and text structure on comprehension processes during reading of scientific texts. *Memory & Cognition*, *35*(7), 1567-77. https://doi.org/10.3758/BF03193491

Kintsch, W., & van Dijk, T. A. (1978). Towards a model of text comprehension and production. *Psychological Review*, *85*, 363-94.

Laerd Statistics. (2015). Simple linear regression using spss statistics. *Statistical Tutorials and Software Guides.* https://statistics.laerd.com/

Lake Michigan College. (2013). *Prerequisites.* Author. Benton Harbor, MI. https://wave.lakemichigancollege.edu/PROD/

Lepine, R., Bernardin, S., & Barrouiller, P. (2005). Attention switching and working memory spans. *European Journal of Cognitive Psychology*, *17*(3), 329-45. https://doi.org/10.1080/09541440440000014

Little, E. E. (1999). *An exploration of the metacognitive awareness and reading comprehension achievement of first semester community college students*. Dissertation. University of Maryland, College Park, Maryland. ProQuest

University of Michigan #9926774.

Makovski, T., Sussman, R., & Jiang, Y. V. (2008). Orienting attention in visual working memory reduces interference from memory probes. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *34*(2), 369-80. PubMed Database. PMID: 18315412.

McCray, A. T. (2005). Promoting health literacy. *Journal of the American Medical Informatics Association*, *12*(2), 152-163. https://doi.org/10.1197/jamia.M1687

McGettigan, C., Warren, J. E., Eisner, F., Marshall, C. R.,Shanmugalingam, P., & Scott, S. (2011). Neurological correlates of sublexical processing in phonological working memory. *Journal of Cognitive Neuroscience*, *23*, 961-77. https://doi.org/10.1162/jocn.2010.21491

Mokhtari, K., Dimitrov, D. M., & Reichard, C. (2018). Revising the metacognitive awareness of reading strategies inventory and testing for factorial invariance. *Studies in Second Language Learning and Teaching*, *8*(2), 219-46. https://doi.org/10.14746/ssllt.2018.8.2.3

Mokhtari, K., & Reichard, C. (2002). Assessing students' metacognitive awareness. *Journal of Educational Psychology*, *94*(2), 249-259.

Molloy College. (2014). *Admissions*. Author. Rockville, NY. https://www.molloy.eduadmissions/freshman_admissions/nelson_denny_test_faq_nelson_denny_math_s

Nash-Dietzel, S. (2010). Metacognitive reading strategies can improve self-regulation. *Journal of College Reading and Learning*, *40*(2), 45-63.

Narvaez, D., van den Broek, P., & Barron Ruiz, A. (1999). The influence of reading purpose on inference generation and comprehension in reading. *Journal of Educational Psychology*, *91*(3), 488-496. https://doi.org/10.1037/0022-0663.91.3.488

Norris, D. (2013). Models of visual word recognition. *Trends in Cognitive Sciences*, *17*(10), 517-524. https://doi.org/10.1016/j.tics.2013.08.003

O'Neill, S. P. (1992). Metacognitive strategies and reading achievement among developmental students in an urban community college. *Reading Horizons*, *32*(4), online. https://scholarworks.wmich.edu/cgi/viewcontent.cgi?article=1574&context=reading_horizons.

Paris, S. G., Lipscon, M. Y., & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology*, *8*, 293-316.

Poissant, H. (1994). April. *Assessing and understanding the cognitive and metacognitive perspectives of adults who are poor readers. Technical Report No. 594*. Center for the Study of Reading. Urbana, IL. ERIC: 367958.

ProEd Inc. (1993). Nelson Denny Reading Test Version G & H. Author. Austin, Texas. https://www.proedinc.com/products/ndrt

ProEd Inc. (2019). Nelson Denny Reading Test Version I & J. Author. Austin, Texas. https://www.mindresources.com/education/059905

Rapp, D. N., van den Broek, P., McMaster, K. L., Kendeou, P., & Espin, C. A. (2007). Higher-order comprehension processes in struggling readers: A perspective for

research and intervention. *Scientific Studies of Reading, 11*(4), 289–312. Lawrence Erlbaum Associates, Inc. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.514.8956&rep=rep1&type=pdf

Rayner, K., Slattery, T. J., Drieghe, D., & Liversedge, S. (2011). Eye movements and word skipping during reading: Effects of word length and predictability. *Journal of Experimental Psychology, Human Perception, and Performance*, *37*(2), 514-528. PMC3543826.

Ready, R. E., Chaudhry, M. F., Schatz, K. C., & Strazzullo, S. (2013). "Passageless" administration of the Nelson-Denny reading comprehension test: associations with IQ and reading skills. *Journal of Learning Disabilities*, *46*(4), 377-84. https://doi.org/10.1177/0022219412468160

Reid, A. J. (2013). November. *Improving metacomprehension and calibration accuracy through embedded cognitive and metacognitive strategy prompts*. Dissertation. Old Dominion University. ProQuest Dissertations Publishing #3579622.

Royer, J. M., Abranovic, W. A., & Sinatra, G. M. (1987). Using entering reading comprehension performance as a predictor of performance in college classes. *Journal of Educational Psychology*, *79*(1), 19-26. http://dx.doi.org/10.1037/0022-0663.79.1.19

Schmitt, M. C., & Sha, S. (2009). The developmental nature of meta-cognition and the relationship between knowledge and control over time. *Journal of Research in Reading*, *32*(2), 254 – 271. https://doi.org/10.1111/j.1467-9817.2008.01388.x

Schommer, M., & Surber, J. R. (1986). Comprehension-monitoring failure in skilled adult readers. *Journal of Educational Psychology*, *78*(5), 353-357. http://dx.doi.org/10.1037/0022-0663.78.5.353

Sheorey, R., & Mokhtari, K. (2001). Differences in the metacognitive awareness of reading strategies among native and non-native readers. Author. https://www.researchgate.net/profile/Kouider_Mokhtari/publication/223776514_Differences_in_the_metacognitive_awareness_of_reading_strategies_among_native_and_non-native_readers/links/5a83849caca272d6501eb99a/Differences-in-the-metacognitive-awareness-of-reading-strategies-among-native-and-non-native-readers.pdf

Singhal, M. (2001). Reading proficiency, reading strategies, metacognitive awareness and l2 readers. *The Reading Matrix*, *1*(1), online. www.readingmatrix.com/articles/singhal/

South Carolina Police Department. (2018). *South Carolina Police Exam Prep.* Author. https://www.jobtestprep.com/south-carolina-police-exam-prep

SPSS, Inc. (2014). IBM SPSS 25.0.0 *Tutorial online: IBM SPSS statistics.* Author. http://ibmproducts.com/spss/software.

Sundermeier, B. A., Virtue, S. M., Marsolek, C. J., & van den Broek, P. (2005). Evidence for dissociable neural mechanisms underlying inference generation in familiar and less-familiar scenarios. *Brain and Language*, *95*(3), 402-13. https://doi.org/10.1016/j.bandl.2005.03.005

Taraban, R., Kerr, M., & Rynearson, K. (2004). Analytic and pragmatic factors in college

students' metacognitive reading strategies. *Reading Psychology*, *25*(2), 67-81. https://doi.org/10.1080/02702710490435547

Taraban, R., Rynearson, K., & Kerr, M. (2000). College students' academic performance and self-reports of comprehension strategy use. *Reading Psychology*, *21*(4), 283-308. https://doi.org/10.1080/027027100750061930

Tarchi, C. (2017). Comprehending and recalling from text: The role of motivational and cognitive factors. *Issues in Educational Research*, *27*(3), 600-619. http://www.iier.org.au/iier27/tarchi.html

Taylor, J. S. H., Plunkett, K., & Nation, K. (2011). The influence of consistency, frequency, and semantics on learning to read. An artificial orthography paradigm. *Journal of Experimental Psychology-Learning, Memory and Cognition*, *37*(1), 60-78. Science Citation Index Database. ISSN: 02787393.

Tzeng, Y., van den Broek, P., Kendeou, P., & Lee, C. (2005). The computational implementation of the landscape model: Modeling inferential processes and memory representations of text comprehension. *Behavior Research Methods*, *37*(2), 277-86. https://doi.org/10.3758/BF03192695

van den Broek, P. (2012). Individual and developmental differences in reading comprehension: Assessing cognitive processes and outcomes. In J. P. Sabatini,E. R. Albro, & T. O'Reilly (Eds.), *Measuring up: Advances in how we assess reading ability* (pp. 39 –58). Lanham, MD: Rowman & Littlefield Education.

van den Broek, P., & Espin, C. A. (2012). Connecting cognitive theory and assessment: Measuring reading differences in reading comprehension. *School Psychology*

Review, *41*(3), 315-25. https://www.researchgate.net/publication/285908866_Connecting_cognitive_theory_and_assessment_Measuring_individual_differences_in_reading_comprehension

van den Broek, P., Rapp, D. N., & Kendeou, P. (2005). Integrating memory-based and constructionist processes in accounts of reading comprehension. *Discourse Processes*, *39*, 299 –316. https://doi.org/10.1080/0163853X.2005.9651685

van den Broek, P., Virtue, S., Gaddy, M., Tzeng, Y., & Sung, Y. (2002). Comprehension and memory of science texts: Inferential processes and the construction of a mental representation. *The Psychology of Science Text Comprehension*, 131-54. Publication #309107590.

Van Dyke, J. A., Johns, C. L., & Kukona, A. (2014). Low working memory capacity is only spuriously related to poor reading comprehension. *Cognition*, *131*(3), 373-403. https://doi.org/10.1016/j.cognition.2014.01.007

Virtue, S., van den Broek, P., & Linderholm, T. (2006). Hemispheric processing of inferences: The effects of textual constraint and working memory capacity. *Memory & Cognition*, *34*(6), 1341-54. https://doi.org/10.3758/BF03193276

Waechter, S., Besner, D., & Stolz, J. A. (2011). Basic processes in reading: spatial attention as a necessary preliminary to orthographic and semantic processing. *Visual Cognition*, *19*(2), 171-202. https://doi.org/10.1080/13506285.2010.517228

Waechter, S., Stolz, J., & Besner, D. (2010). Visual word recognition: On the reliability of repetition priming. *Visual Cognition*, *18*(4), 537-58. ISSN: 1350-6285.

Williams, R. L., Skinner, C. H., & Jaspers, K. E. (2007). Extending research on the validity of brief reading comprehension rate and level measures to college course success. *The Behavior Analyst Today*, *8*(2), 163-174. http://dx.doi.org/10.1037/h0100610

Wolf, M., Bowers, P. G., & Biddle, K. (2000). Naming-speed processes, timing, and reading: A conceptual review. *Journal of Learning Disabilities*, *33*(4), 387-407. https://doi.org/10.1080/19388070

Yeari, M., & van den Broek, P. (2011). A cognitive account of discourse understanding and discourse interpretation: The landscape model of reading. *Discourse Studies, 13*(5), 635-43. https://doi.org/10.1177/1461445611412748

Yuksel, I., & Yuksel, I. (2011). Metacognitive awareness of academic reading strategies. *Social and Behavioral Sciences*, *31*, 894-898. https://doi.org/10.1016/j.sbspro.2011.12.164

Zhang, L., & Sepho, S. (2013). Metacognitive strategy use and academic reading achievement: Insights from a Chinese context. *Electronic Journal of Foreign Language Teaching*, *10*(1), 54-69. Center for Language Studies, National University of Singapore, China. www.e-flt.nus.edu/sg/v10n12013/zhang.pdf

Appendix A: Recruitment Cards

Volunteer to be part of a research study about silent reading, in exchange for a $10.00 café gift card and less than one hour of your time.

If you are 18 years old or older, a high school graduate, a current student in college or university and willing to read silently in a group setting and complete a checklist about your reading experiences, stop by this week at:

Building NAME, room #___ ,
during One of the following days and times listed below.

Morning start times begin at:

9:00 a.m.
10:30 a.m.

Afternoon start times begin at:
1:00 p.m.
2:30 p.m.
4:00 p.m.
5:30 p.m.

Calendar dates for session times:

M	T	W	T	F
1	2	3	4	5

Appendix B: Demographic Information Page

Years in undergraduate program: [ ] 1st year

[ ] 2nd year

[ ] 3rd year or more

Age: ____ years old

Appendix C: Metacognitive Awareness of Reading Strategies Inventory-Revised

For each statement 1-15, write a number from one to five that best matches your awareness or use of that strategy during your reading experience today. When you are finished, please place your packet on the table and pick up your gift card. Thank you.

1. I have never heard of this strategy before.
2. I have heard of this strategy, but I don't know what it means.
3. I have heard of this strategy, and I think I know what it means.
4. I know this strategy, and I can explain how and when to use it.
5. I know this strategy quite well, and I often use it when I read.

Strategies 1-15

_____ 01. Having a purpose in mind when I read.

_____ 02. Taking notes while reading.

_____ 03. Previewing the text to see what it is about before reading it.

_____ 04. Reading aloud to help me understand what I'm reading.

_____ 05. Checking to see if the content of the text fits my purpose for reading.

_____ 06. Discussing what I read with others to check my understanding.

_____ 07. Getting back on track when getting sidetracked or distracted.

_____ 08. Underlining or circling important information in the text.

_____ 09. Adjusting my reading pace or speed based on what I'm reading.

_____ 10. Using reference materials such as dictionaries to support my reading.

_____ 11. Stopping from time to time to think about what I'm reading.

_____ 12. Using typographical aids like bold face and italics to pick out key information.

_____ 13. Critically analyzing and evaluating the information read.

_____ 14. Re-reading to make sure I understand what I'm reading.

_____ 15. Guessing the meaning of unknown words or phrases.

Appendix D: Publisher Permission to Adapt the Nelson Denny Reading Test for Research Use

> > --- On Thu, 4/11/13, [redacted]
> > wrote:
> > > From: [redacted]
> > > Subject: RE: FW: study use
> > > To: "'Mary Lukes'" [redacted]
> > > Date: Thursday, April 11, 2013, 11:37 AM Mary,
> > >
> > > I've attached your permission contract to adapt
> the
> > NDRT in the
> > > fashion you have stated through past emails. If
> you
> > notice any major
> > > changes that need to be made please let me know.
> > >
> > > Also, Pro-Ed is willing to send you a copy of the
> NDRT
> > in exchange for
> > > a copy of your completed dissertation once it is
> > finished.
> > > Would you be
> > > interested in this free test kit? If so, let me
> know
> > the best address
> > > to ship the test kit to and I'll get it going out
> > ASAP.
> > >
> > > Thanks and good luck,
> > > [redacted]
> > > Permissions Editor
> > > PRO-ED INC.

Appendix E: Letter to Host Campus

Date

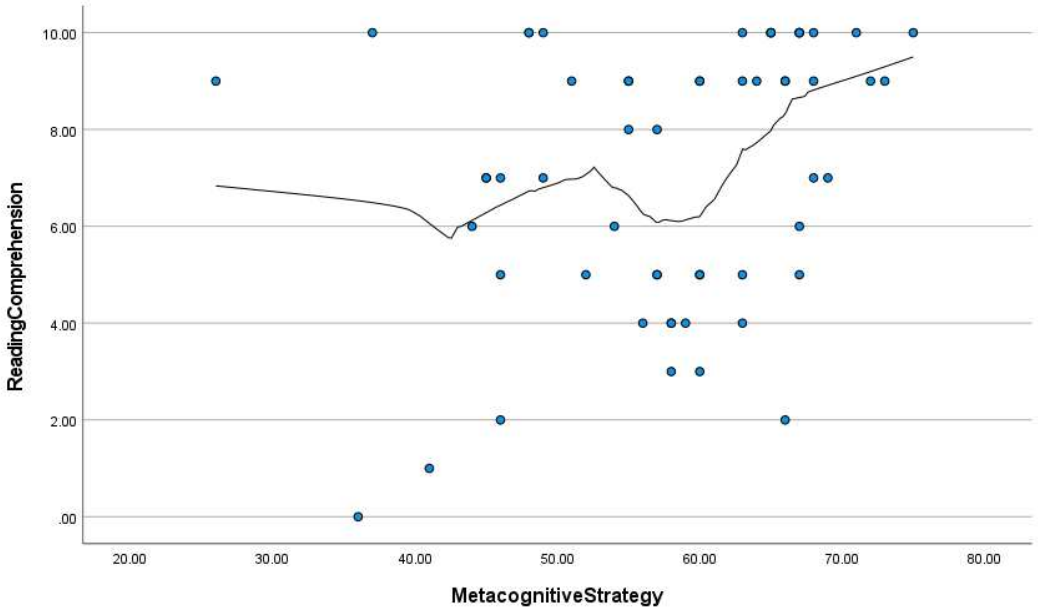
Address

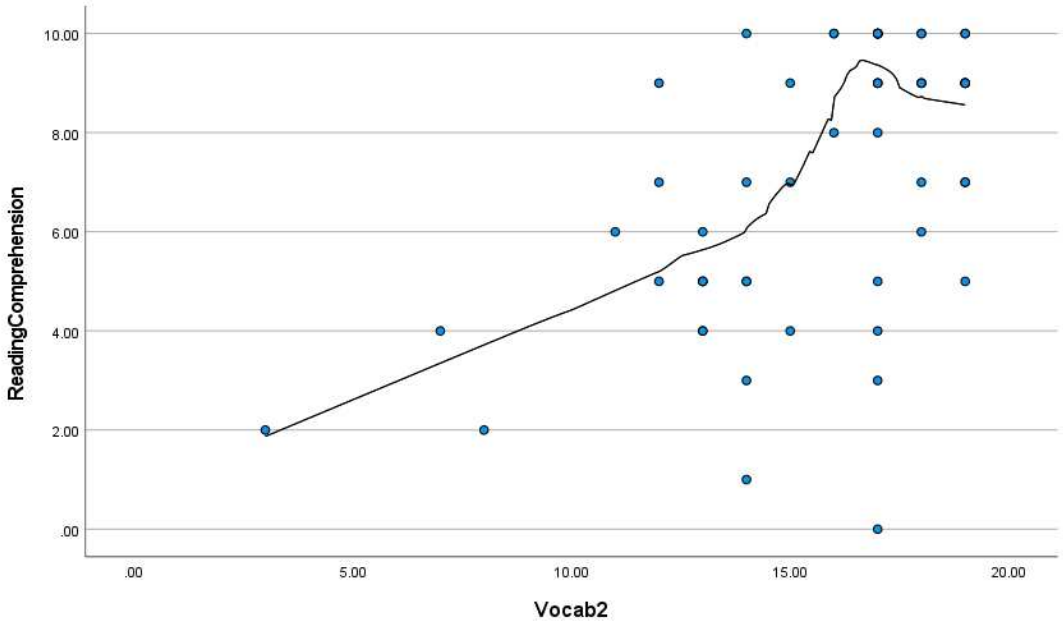
Dear [Dean or Director],

My name is Mary Lukes and I am a doctoral learner at Walden University in the Psychology, General Educational track program. I am seeking a host campus for volunteer adult learner recruitment and study participation for my dissertation project. If possible, I would like to use an empty classroom or study room such as in the library to meet with volunteers who participate in one of the group seating sessions. Volunteer study participants will meet once to complete silent reading tasks and to provide written feedback about their reading experiences. Participants will be asked to volunteer approximately one hour of their time without follow up contact from the researcher. One week is the anticipated time needed for obtaining approximately 120 volunteer participants needed for the study's data collection. All participants and host university names and identifying information will remain anonymous. The host university granting permission for the study recruitment and data collection will be given a copy of the researcher's dissertation upon study completion and acceptance of the dissertation by Walden University. My dissertation chair is Dr. Rainforth at Walden University in Minneapolis, Minnesota [redacted]. My personal telephone contact and e:mail are provided, if you would like more information or a copy of my proposal. Thank you in advance for your consideration regarding this matter.

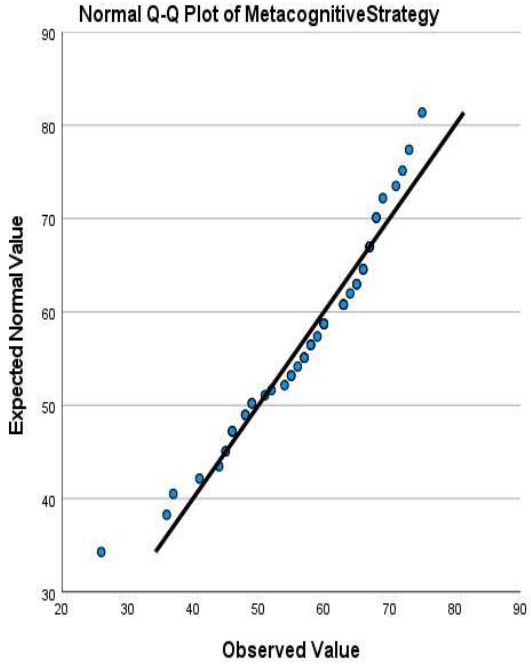
Mary Lukes

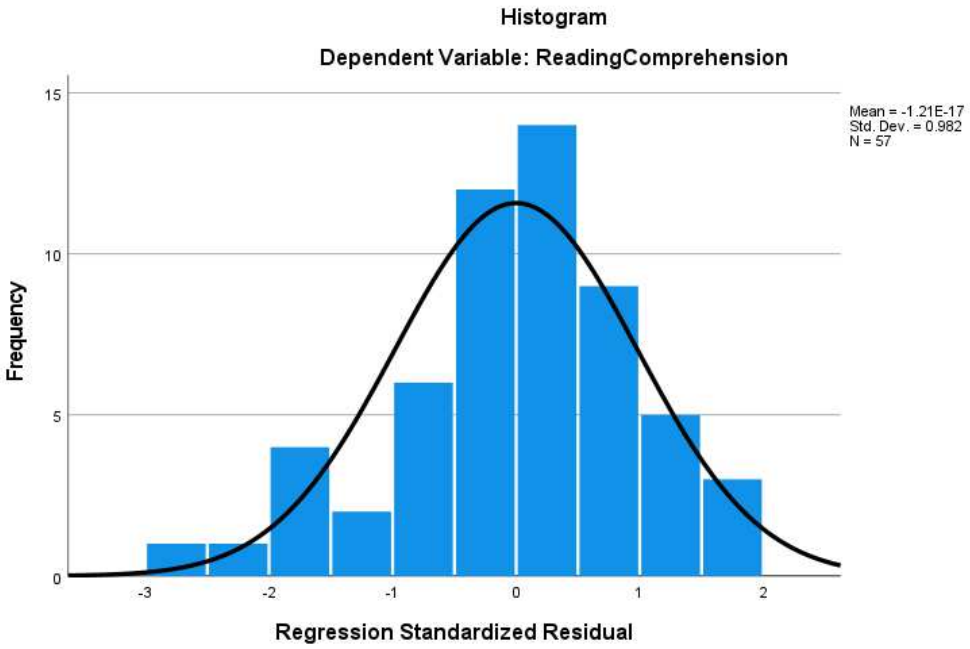
Appendix F: Scatterplots of Study Variables





Appendix G: Q-Q Plot of Residual Metacognitive Strategy Scores





Appendix H: Scatterplot of Residual Reading Comprehension Scores