Scaffolding learning from informational texts in the intervention setting

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Dedication

I would like to dedicate this dissertation to teachers who work tirelessly to educate children, scaffold their learning, and care for their development. Our world is better because of you.

Abstract

The act of creating meaning with texts is complex, and this complexity creates unclear views of instruction in schools and even greater perplexity in knowing how to instruct students who may be struggling in this area of their schoolwork. Comprehension is often measured in schools as a product and an outcome, making it difficult to understand why a student may be experiencing challenges (Duke & Carlisle, 2011). Recently, the emphasis of developing reading skills in isolation in schools is being replaced by the importance of gaining knowledge and building cognition while reading (Cervetti & Hiebert, 2014); yet, handing a difficult non-fiction text to students to read, without considering complex and interrelated factors that influence comprehension does not put students on the path to create meaning with informational texts (Duke, 2014).

This study examines that pathway by implementing a reading intervention for fourth and fifth grade students in collaboration with six reading specialists within one mid-western school district. Using design-based research (McKenney & Reeves, 2012), I investigate theory in the context of practice with the dualistic goals of improving practice and developing theoretical understanding of learning. The intervention draws on the Landscape Model (van den Broek, Rapp & Kendeou, 2005) to provide a framework for the dynamic interaction of cognitive processes involved with comprehension. Findings indicate that grouping texts by content area influences students' cognitive processes while reading texts, is valuable for comprehension development, and impacts the comprehension product. In addition, the implementation of verbal protocols as a

formative assessment tool enables reading specialists to identify students' unique challenges while reading and to coach students while processing texts.

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Chapter 1: The Path to This Topic

Comprehension is necessary for learning and processing essentially all of the information available in texts. It is the purpose of reading. When students comprehend texts they gain knowledge about the world, experience the life of another character, enrich their vocabulary, engage critically, and broaden their understanding of life. When students comprehend texts they have access to new ideas and increased knowledge that supports the comprehension process with increasingly difficult texts.

While many students in schools reap the benefits that come from reading texts with strong comprehension, there are some students who struggle to understand the texts that they read. Evidence of students' difficulties with comprehension can be found through low comprehension scores on standardized assessments, written responses to text that indicate only a surface level understanding of texts, and teacher observations that record students' off task behavior as they struggle to stay focused while reading texts they don't understand or enjoy. Their struggle with comprehension escalates throughout school, as knowledge missed in earlier texts is needed to understand increasingly difficult texts. Within a single classroom in schools, many students may appear to be reading, but they are not gaining the benefits of reading with engagement and strong comprehension of texts.

The act of creating meaning with texts is complex, and this complexity makes comprehension instruction in schools difficult. Practitioners face significant challenges when planning instruction for students who struggle with comprehension. These

challenges include knowing how to measure students' comprehension, knowing how to scaffold instruction, and knowing how to intervene when students struggle.

Comprehension is most often measured in schools as a product and outcome, and this makes it difficult to know where and why comprehension is breaking down for individual readers (Duke & Carlisle, 2011; Rapp, van den Broek, McMaster, Kendeou & Espin, 2007). Comprehension is actually a cognitive process, and in order to plan instruction for students who struggle with comprehension, it is important for teachers to understand how individual student's process texts. This understanding can lead to scaffolded instruction, which is essential for comprehension development (Clark & Graves, 2005).

My Background as a Teacher

As a classroom teacher and reading specialist I have worked with a number of elementary-aged students who struggled with comprehension. As a way to better understand the students' instructional needs I studied a variety of assessment data for each student including standardized assessments, individual reading inventories, end-of-unit tests, and students' written responses to texts. None of these assessments provided the answers I was looking for. Standardized assessments indicated whether students were below, at, or above grade level in comparison to their peers, but these assessments were infrequent, and I questioned the reliability of the results. On standardized assessments, students' scores jumped and dropped in extreme ways. As an example, one of my students scored at the 17% in the fall assessment, and then at the 70% in the winter assessment. Another student scored at the 64% in the fall and dropped to the 32% in the

winter. None of these scores aligned to classroom measures. End-of-unit tests in curriculum left me wondering whether students struggled because of decoding accuracy, text difficulty, interest in reading, attention allocation, or challenges with language and vocabulary. When students wrote responses to text they demonstrated evidence of thinking and engagement, but the student's writing didn't often lead to diagnostic understanding of a student's difficulty. The Qualitative Reading Inventories (Leslie, Lauren & Caldwell, 2006) and Developmental Reading Assessments (Beaver, 1997) helped me understand whether an individual student's struggle to have success with a particular text was related to decoding, fluency, or comprehension, and these assessments also helped me see how readers performed when texts increased in difficulty. Yet, when students were not able to answer literal or inferential questions related to the text they read, or struggled to retell a text they decoded accurately and fluently, I still didn't have diagnostic information to understand this difficulty.

In an effort to meet the instructional needs of my students I consulted research of best practices for comprehension instruction. Based on this research, I provided authentic and engaging texts, differentiated instruction by varying text difficulty and levels of support, offered students' choice related to texts and tasks, modeled and coached reading strategies, worked with vocabulary, emphasized higher order thinking book club discussions, read from a variety of genre, taught annotation skills, implemented reciprocal teaching, and Question And Response (Raphael & Au, 2005). Though I value all of these approaches for comprehension development and believe they are supportive of learning, I lacked formative assessment information to know if my instruction was

matched well to students' needs. The cause of each student's struggle was generally unclear to me, and this made it difficult to know if my instruction was supporting the individual's comprehension development. Without an understanding of individual students' processes with texts, I was unclear about the impact of my instruction related to comprehension development with them.

I met with involved and supportive parents who wanted to know more about how they could help their children, and I wished I had more answers and ideas to provide. This desire to better understand students' comprehension as a way to improve my instruction and support individual children who were struggling with comprehension led to my research project for my Master of Arts (MA) degree.

Graduate Work

My MA degree research project focused on hearing kids think. For this project I wanted to better understand students' processes with comprehension and how these processes might vary between secure readers and developing readers. I selected six students from my third grade classroom, three students who consistently demonstrated secure comprehension on standardized assessments, curriculum assessments, written responses to text, classroom discussion, and the QRI, and three students who struggled on these same measures. Each student met with me independently and read four texts out loud; two of these texts were narrative and two of the texts were informational. Cueing for the reader was general based on the recommendation of Pressley and Hilden (Mallette & Duke, 2004). The cue, "What are you thinking about your reading?" was provided three times: before, during, and after reading. Listening to each of these students read and

think out loud provided deeper insight into the comprehension processes for secure and developing readers.

I was immediately struck by the different amounts of thinking statements provided by the students. Secure readers provided 125 thinking statements across the four texts they read, while developing readers provided 64 thinking statements across the same four texts. The difference in the amount of thinking between the secure and developing readers was especially noteworthy **during** the reading of the text. Secure readers shared most of their thinking **as** they read, whereas developing readers shared most of their thinking **before** and **after** they read. When analyzing the thinking statements of the students in my study, it was clear that secure readers fit the description of a massively active reader (Pressley & Afflerbach, 1995). Secure readers revealed processes through verbal protocols such as checking meaning with an initial hypothesis, identifying important information in the text, consciously making inferences and integrating different parts of the text, making interpretations, and monitoring comprehension while reading. However, these cognitive processes were rarely visible among thinking statements in the developing reader group. In addition, there were clear differences in comprehension monitoring while reading. Both the developing and secure readers made a total of 25-30 decoding errors across the four texts; however, the secure group self-corrected one in two of these errors while the developing group only self-corrected one in five of these errors. Students in the secure group questioned the meaning of unfamiliar words thirteen times, whereas in the developing group a word meaning was only questioned once. The secure group slowed their reading when coming to unfamiliar

vocabulary or challenging concepts 21 times, self-adjusting reading rate to focus on meaning. In the developing group reading rate was only adjusted twice while reading, and seven times students skipped a line of reading without slowing down to question why the reading didn't make sense.

Intrigued and concerned by these findings, I was interested to know if my findings would be duplicated among a new group of students. Last year I repeated this study (Bergeson & Rosheim, 2015) in a sixth grade classroom. Six students were selected for this study and grouped using the following assessment data: Northwest Education Assessments (Northwest Evaluation Association, 2003) at multiple time points, Fountas & Pinell Benchmark assessment System (Fountas & Pinnell, 2008), informal reading inventory, classroom observation, reading response journals and writing samples. Based on the result of these assessments, Kay Rosheim categorized students as 'secure' or 'developing' in regards to consistent demonstration of successful reading. The text used in this study was a district assigned science curriculum read on the iPad. Over the span of two weeks, students met in a quiet room with me for approximately 30 minutes per student on 3 separate days. During this time students read their assigned science texts on their iPads and shared thinking out loud. Again, the cue, "What are you thinking?" was provided before, during, and after reading. A total of one hundred ninety six minutes of audio recorded reading and think aloud statements were collected and analyzed.

The findings from this study were strikingly similar to my previous study. Secure readers provided a total of 111 thinking statements, whereas developing readers provided

a total of 33 thinking statements. Secure readers initiated the majority of their thinking statements without a prompt, and these statements most often occurred **during** reading. In comparison, developing readers only shared statements when prompted, and these statements most often occurred **before** or **after** reading. Again, secure readers fit Pressley and Afflerbach's (1995) description of a massively active reader. Thinking statements for secure readers demonstrated an active search for overall meaning of the text. For example, students shared predictions as they read and drew on their prior knowledge. New information either confirmed the accuracy of predictions or shifted understanding to account for new learning and enriched understanding of concepts. An interest in learning about concepts in the text was stated, and texts were evaluated based on their effectiveness in helping students learn. In contrast, developing readers rarely initiated thinking statements as they read, and when prompted to share their thinking, the most common statement in 70% of their responses was, "I'm not thinking anything." Both of these studies left me with the impression that the amount of learning and understanding that happens in the act of reading in classrooms differs dramatically among students. Table 1 and Table 2 display summative verbal protocol data from these two studies.

Table 1

Total Number of Verbal Protocol Statements in Third Grade Study Adapted from Constructively Responsive Reading (Pressley & Afflerbach, 1995)

Third Grade Readers	Developing	Secure
Before	9	14
During	8	71
After	8	20
Total	25	105

Table 1

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Third Grade Readers	Developing	Secure
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During	8	71
After	8	20
Total	25	105

Table 2

Total Number of Verbal Protocol Statements in Sixth Grade Study Adapted from Constructively Responsive Reading (Pressley & Afflerbach, 1995)

Sixth Grade Readers	Developing	Secure
Before	11	9
During	8	76
After	14	26
Total	33	111

This comparison shows the significance of the difference in conscious processing of texts between secure and developing readers. Table 3 below identifies processes not evident in developing readers that were evident in secure readers. Table 3 combines the number of responses made among developing readers and secure readers at both school sites.

Table 3
Pre-determined categories: During Reading
Adapted from Constructively Responsive Reading (Pressley & Afflerbach, 1995)

During Reading Categories	**Developing**	**Secure**
Read, checking meaning with initial hypothesis	4	9
Identify important information from text	1	12
Consciously make inferences	0	16
Integrate different parts of the text	0	12
Make interpretations	1	17
Monitor cognitive processes	3	24
Make evaluations of style and content	1	6
Paraphrase	1	1
Predict and substantiate on predictions	0	9
Explicitly look for related words, concepts or ideas and use them to construct a gist	2	9
Reset learner goals at a different level based on understanding of text	0	2

Verbal protocols are commonly used as a way to collect data for research studies; yet, I believe they have the potential to provide important information for teachers. Both of these studies left me wanting to explore the use of verbal protocols as a formative assessment tool for teachers to better understand cognitive processing of texts among individual students in schools. Further, I continued to wonder about instructional approaches that would support comprehension development for students whose comprehension processes did not show evidence of active, engaged, and secure reading. These questions led me to the current study.

My Doctoral Work

The pathway from a student's struggle with comprehension to secure comprehension has not yet been fully developed. My study investigates that pathway by designing and implementing a reading intervention for students who have been identified for Tier 2 level of support in reading. The project is set in schools to better understand

development within authentic contexts and related to instruction for students currently identified as struggling with reading comprehension.

As I planned my study I wanted to address two main research questions. First, I wondered, “In what ways does a group of reading specialists use information from verbal protocols for their instruction? My first question examines verbal protocols used by reading specialists in a small group reading intervention to see if prompting students to think out loud provides useful diagnostic or formative assessment information for students with whom reading specialists work. Second, I wondered, “In what ways do content familiarity, text difficulty, and reading for authentic purposes interact with learning?” This second question investigates instructional approaches, not commonly used in intervention settings.

Chapter 2: Literature Review

Comprehension is an act of understanding that draws on everything a reader has learned their entire lives. This broad topic includes decoding skills, fluency, vocabulary, language, culture, comprehension strategies, higher-order thinking skills, metacognition, genre, text difficulty, and content familiarity, among others. All of these factors interact in multifaceted and self-perpetuating ways (Paris, 2005).

The complexity of comprehension creates unclear views of comprehension instruction in schools and even greater perplexity in knowing how to instruct a student who may be struggling. A majority of intervention research has studied reading outcomes that pick apart the intricacy of reading as isolated basic skills; yet, reading comprehension only emerges with the engagement of the reader, with a text, situated in a setting, for a purpose, at a particular point in time (Paris, 2005; Pardo, 2004; Rosenblatt, 1978). It is rare to find intervention research that occurs in natural settings and takes into account higher order literacy proficiencies, and the critical integration of individual students' background knowledge with text.

Recently, Common Core Standards have supported the development of background knowledge for literacy by increasing content area literacy and the use of informational texts in schools (Cervetti & Hiebert, 2014) The emphasis of developing reading skills in isolation is being replaced by the importance of gaining knowledge and building cognition while reading; yet, handing a difficult non-fiction text to students to read, without considering complex and interrelated factors that influence comprehension,

does not put students on the path to engaged construction of meaning with informational texts (Duke, 2014; Fisher & Frey, 2015).

The pathway from a student's struggle with reading comprehension to secure reading of informational texts is not yet fully understood (Duke & Carlisle, 2011). For this literature review, I examine that pathway by first considering a few landmark studies related to comprehension instruction in schools. Next, I review literature that describes views of students who struggle with reading and ways these students have been positioned and instructed in schools. After that, I describe factors that delineate individual students' processes with comprehension, along with measures used to identify these factors in schools. Finally, I establish a theoretical framework to provide a foundation for the design of a new approach to reading comprehension support for upper elementary age students who struggle to adequately comprehend grade-level, content-area texts.

Landmark Studies for Comprehension Instruction

Comprehension instruction is an assumed practice in schools. This assumption came into question in 1978 when Dolores Durkin (1978) and two research assistants observed thirty-nine classrooms of upper elementary age students during reading and social studies instruction time and found that little to no comprehension instruction had occurred in the 299.95 hours of observation. Instead, comprehension activities primarily focused on assessments through teacher questioning and written assignments. The researchers were also troubled to find that none of the observed teachers in this study viewed content area reading as an opportunity to support students with reading comprehension. Twenty years later Pressley, Wharton-McDonald, Hampston, &

Echevarria (1998) conducted a similar study with similar results. In their study, researchers observed 10 classrooms over the course of a year, and comprehension assessment, rather than comprehension instruction, was the primary comprehension activity. Despite development in the area of reading comprehension, and an emphasis on increasing comprehension instruction in schools, teachers still struggled to provide instruction to students in the area of reading comprehension.

To support comprehension instruction in schools, researchers studied processes of skilled readers and developed an instructional approach to teach these processes to students in schools. This became known as comprehension strategy instruction (Pearson, Roehler, Dole, & Duffy, 1992). David Pearson and his colleagues defined comprehension strategies as conscious and flexible plans that readers apply and adapt to different texts and tasks. Strategy instruction is about laying bare the processes involved with comprehension so that students will be able to independently apply these processes, when needed, to better understand texts they read. A substantial body of research supports teaching students comprehension strategies as a way to improve reading comprehension (National Reading Panel, 2000; Duke, Pearson, Strachan & Billman, 2002).

Many teachers, though, struggle to incorporate strategy instruction into their classrooms and continue to teach comprehension strategies as if they were teaching comprehension skills (Afflerbach, Pearson & Paris, 2008; Pearson, 2009; Keene & Zimmerman, 2013). Good comprehension strategy instruction is flexible, interactive and constructivist. The goal of strategy instruction is for students to independently and flexibly use strategies they need to better understand their reading. Instructional

approaches, such as Reciprocal Teaching (Palinscar & Brown, 1984) and Transactional Strategies Instruction (Brown, Pressley, van Meter & Schuder, 1996) provide a framework that supports this goal by integrating multiple comprehension strategies into a lesson. In both of these approaches, students use strategies flexibly as they read and engage in conversations about the text.

Another important finding related to comprehension instruction in schools is that students show higher gains in reading when their teachers engage them in higher order thinking (Taylor, Pearson, Peterson & Rodriguez, 2003; Peterson & Taylor, 2012). Taylor and colleagues conducted a study that included 88 teachers, 792 students and nine separate schools. Data collectors for this study observed three hour-long lessons in each of 88 classrooms and documented practices that were later correlated to student assessment scores. Through hierarchical linear modeling (HLM) analysis, researchers discovered that in first through fifth grade, students' reading scores and cognitive engagement with texts increased when their teachers asked higher-level questions. Multiple studies, such as with book clubs (Raphael & McMahon, 1994) and Questioning the Author (Beck, Sandora, Kucan &Mckeown, 1996) also supported higher order thinking for comprehension development by providing a framework to engage students in higher-level talk about text.

At the turn of the century, Nell Duke (2000) influenced comprehension instruction when she documented the scarcity of informational text experiences in classrooms. Over the course of a year, she observed 20 first grade classrooms and found that few informational texts were placed in classroom libraries, on walls, or used during

classroom language activities. In addition, teachers spent only an average of 3.6 minutes per school day with informational texts. This number was even smaller in low socioeconomic settings. Nell Duke influenced policy and standards through her research on informational texts, and this raised the expectations for students to learn from informational texts in schools. Despite her efforts, children's exposure to informational texts in schools is still limited (Yopp & Yopp, 2012).

Views of Students Who Struggle with Reading

There are some students in schools who struggle to create meaning with the texts they are reading. Researchers and educators have hypothesized the cause of this struggle from a variety of perspectives over the past hundred years. Three distinctly different views were prominent during this time and influenced instruction related to this struggle. These views describe students' difficulty with reading as a cognitive processing deficit, a discrepancy between ability and achievement, or a transaction that is influenced by contexts for learning (Mceneaney, Lose & Schwartz, 2006).

Cognitive Processing Deficits

The view of reading difficulties that dominated thinking through much of the 20th century described reading difficulties as cognitive processing deficits (Mceneaney et al., 2006). Students who struggled to comprehend texts were 'diagnosed' with deficits that were assumed to be medical disorders. These medical conditions varied from brain injuries to congenital conditions. During this time, teams of physicians, pediatricians, ophthalmologists, psychiatrists, and neurologists joined educators in searching for the cause of reading difficulties, and a variety of labels were used to describe students.

Labels such as ‘congenital word blindness,’ ‘retarded reader,’ ‘remedial reader,’ ‘slow,’ and ‘disabled reader’ created a view of readers as deficient and abnormal (Dudley-Marling, 2011). These cognitive deficit models influenced both educators and researchers; however, over the years, there has not been a strong amount of evidence to categorize difficulties with comprehension based on the cognitive deficit model (Mceneaney et al., 2006).

Discrepancy View of Reading

In the late 1970s the cognitive disability view was replaced by a discrepancy view of reading difficulties (Lose & Schwartz, 2003). IQ assessments in the 1970s revealed that students with average and high IQ scores struggled with reading, and this changed the perception that readers who struggled in schools were cognitively deficient (Mceneaney et al., 2006). Educators and specialists became less concerned with finding a cognitively specific view of reading difficulties or seeking medical diagnosis for the cause of the difficulty. Instead, educators placed reading development on a continuum that attempted to measure IQ ability in relation to achievement (Fuchs & Fuchs, 2006). The discrepancy in these scores was used to statistically qualify a student for extra support, and students receiving this support were labeled as ‘Learning Disabled’. Funding influenced the prominence of the discrepancy view of reading difficulties (Allington, 2013; Fuchs & Fuchs, 2006; Mceneaney et al., 2006). In 1975 the Education of Handicapped Children Act increased funds in Special Education for students who demonstrated a discrepancy between achievement and ability. In response, large numbers of students who struggled with reading were moved to Special Education for their

reading instruction, and articles about reading difficulties increased in special education journals while they decreased in reading journals (Allington, 2013).

Until recently, the discrepancy model was the primary operational definition of reading difficulties for researchers and special education practitioners, and for a time the discrepancy model was also widely accepted by reading educators (Mceneaney et al., 2006). The discrepancy view was not without problems. A significant issue with the discrepancy model was that reading support was withheld from readers until the gap between achievement and ability was statistically deemed wide enough to warrant additional support. Based on the discrepancy view of reading difficulties, many students in schools waited to fail (Mesmer & Mesmer, 2008). Also, students who struggled with reading did not always demonstrate a discrepancy between ability and achievement, and non-discrepant, low-socioeconomic, or low-achieving students fell through the cracks in the discrepancy model of support (Fuchs & Fuchs, 2006).

Response to Intervention and the Transactional Perspective

Most recently, Response to Intervention replaced the discrepancy model. Response to Intervention is a multi-tiered, school-wide intervention framework that provides increasing levels of support for students identified as ‘at risk’ (Johnston, 2010). The identification process for RTI is more flexible than previous models. Data used to indicate ‘at risk’ status may include norm-referenced assessments or criterion referenced assessments, and scores designated to identify ‘at risk’ students may be selected at the school or district level (Mesmer & Mesmer, 2008). After a child has been identified as ‘at

risk' in the regular classroom, the individual student's responsiveness to instruction is monitored, and instruction is altered based on measures of growth.

Response to Intervention changed the delivery of interventions in schools in a few significant ways. RTI established a problem-solving approach to learning, altering and differentiating instruction based on identified students' needs at each tier of instruction (Lose, 2007; Johnston, 2010). Students who do not make progress in the classroom are provided additional individualized instruction in a small group, and teachers with specialized subject matter, teaching skills, and relevant expertise provide this support. In addition, RTI spread funding to students without requiring a discrepancy in achievement and ability scores, and this means that practitioners are given the opportunity to intervene early and dynamically rather than waiting for a child to fail. (Walker-Dalhouse et al., 2009). An important consideration when describing difficulties with reading comprehension is whether or not to locate the difficulty within the reader or within the context for learning, and the RTI framework changed the location of the difficulty by considering learning in relation to the environment (Fuchs & Fuchs, 2006; Mceneaney et al., 2006). This environment takes into account cultural and institutional factors.

The transactional perspective on reading difficulties is similar to RTI in that it situates learning within social, cultural, and institutional factors (Mceneaney et al., 2006). These factors powerfully influence meaning created with texts for individual students. Literacy is not something that happens all at one time, but rather develops in particular ways based on contextual factors (Dudley-Marling, 2011). The relations between a reader, the text, and the context for learning interact and influence meaning created from

texts for individual students (Rosenblatt, 1978). This transactional perspective on reading indicates that when a student does not make adequate progress, the student's 'struggle' resides in complex relationships within social, cultural, and institutional factors.

Despite the current influence of the transactional perspective of reading, students today are often described as 'struggling readers' (Vlach & Burcie, 2010). Though this term is less cognitively deficient and discrepancy oriented, ultimately, this term implies failure. Labels are never harmless (Dudley-Marling, 2011). They put students on paths and reinforce deficit perspectives (Allington, 2013). They have a powerful influence on public policy, legislation, and educational practice (Mceneaney et al., 2006). The term 'struggling reader' implies that a student's effort has not led to accomplished goals, and this narrative removes agency from the reader (Vlach & Burcie, 2010).

There has never been a universal agreement for describing students who struggle with comprehension in schools. Some educators advocate for a theoretically based classification system and reliable definition for reading disabilities, and others believe this is not possible because reading disabilities are largely socially constructed (Allington, 2003). Still, Response to Intervention and the transactional perspective of reading are influential in emphasizing that students acquire reading in different ways and benefit from instructional programs that assume this difference.

Factors that Influence Comprehension

Profiles of difficulties for readers differ dramatically across readers and literacy tasks because the act of creating meaning with texts is complex (Cain & Oakhill, 2006; Kucan & Palinscar, 1984). Some of the reader variables important to consider with

comprehension include individual differences in background knowledge (McNamara & Kintsch, 1996), individual differences in higher-level processes (Kendou, van den Broek, Helder & Karlsson, 2014), and individual differences in standards of coherence (van den Broek, Bohn-Gettler, Dendou & Carlson, 2011).

Background Knowledge

Knowledge supports every aspect of reading, not only because it provides a base of information, but also because it influences how readers interact with text (Brozo, 2010). Knowledge that influences comprehension may include general world knowledge, domain knowledge, content specific facts, conceptual understandings, and word meanings (Cervetti & Hierbert, 2014). Individual reader's differences in knowledge interact with texts and codetermine the acquisition of the content read in texts (Kendeou & van den Broek, 2007; Anderson & Pearson, 1984). In a study that investigated background knowledge with high and low ability readers, background knowledge was shown to better predict outcomes in reading than reading ability (Recht & Leslie, 1988). For this study, sixty-four junior high students were divided into 4 groups on the basis of high and low reading ability and high and low existing prior knowledge about baseball. Students all read a text about a baseball game, retold the story, summarized the game, and sorted sentences based on the importance of the ideas in the text. Background knowledge is such a powerful factor in comprehension that students in this study who struggled with comprehension, but had high knowledge in relation to the text, demonstrated stronger understanding of the text than secure readers.

Reading comprehension is a domain-specific process (Brozo, 2010). Readers who have very familiar knowledge of the domain experience easier comprehension because domain knowledge activates automatically, has little impact on working memory, and fills in gaps in text cohesion (Cervetti & Hierbert, 2014). An individual reader's background knowledge does not always agree with a text though, and when it doesn't agree, readers will either adjust their background knowledge to make it fit or reject the information in the text altogether (Kendeou & van den Broek, 2007). Students come to school with unique background knowledge in relation to each text, and knowing how to support comprehension development for individual readers depends on understanding the important influence of background knowledge.

Knowledge is not simply acquired by reading any text though. The cohesion of texts impacts learning in different ways for different readers. Text cohesion can be defined by sentence and linguistic complexity, and gaps in connections between idea units within the texts (McNamara, Louwerse & Graesser, 2005; Graesser et al., 2014). A study, theoretically motivated by the Construction Integration model, manipulated levels of text cohesion, and demonstrated that the match of background knowledge with cohesion in texts is important for learning (McNamara & Kintsch, 1996). Forty college students were sorted into 2 groups based on existing prior knowledge, and each student read one of two texts: a text with high levels of cohesion or a text with low levels of cohesion. After reading, students answered multiple-choice questions, performed a key word sorting task and recalled what they remembered reading. Readers responded differently to these two texts. Greater text cohesion supported learning, recall, and

memory for readers with low background knowledge in relation to the text, whereas gaps in the cohesion of texts supported learning, recall, and memory for readers with high background knowledge in relation to the text (McNamara & Kintsch, 1996). When educators select texts based on explicitness and greater levels of cohesion, this can improve memory and learning for readers who struggle with comprehension.

As students in schools approach fourth grade, late-identified struggles with reading emerge in the form of challenges with the ability to learn from informational texts (Chall, 1983). Though many students who struggle with reading still lag in decoding ability, stronger correlations are found between expository texts and individual readers' world knowledge (Rapp, van den Broek, McMaster, Kendou, & Espin, 2007). Children with less prior knowledge, in relation to a particular text, are not able to form coherent representations of text because deep comprehension and inferential thinking is not possible in the absence of background knowledge

Some children may have difficulty gaining knowledge from informational texts because these texts generally require students to understand writing that is dense with information, involves less familiar vocabulary, and differs in text structure from narrative texts (Brozo, 2010; Wolfe, 2005). Language use in informational texts is more academic, and familiarity with language plays an important role in comprehension (Uccelli, Galloway, Barr, Meneses & Dobbs, 2015). Though students have opportunities to gain valuable knowledge while reading informational texts, students with lower reading proficiency scores have reported less exposure to reading informational texts in their school day (Moss, 2005).

Higher Order Processes

Individual readers also differ in higher-order cognitive processes such as working memory, attention allocation, and inference making (Kendou, et al., 2014). Working memory is the ability to maintain information in memory while processing incoming information. Working memory is particularly important for comprehension when a task is challenging because students need to keep important information in mind while they exert effort to process new information (Swanson & Berninger, 1995; Linderholm, 2002; Garcia-Madruga et al., 2013). Cain & Oakhill (2004) examined the relationship between working memory and comprehension skills of students at the age of 8, 9, and 11 year olds in a longitudinal study. At each point of time, researchers assessed reading skills, vocabulary, verbal skills, working memory span, and comprehension skills. They determined that working memory better predicted comprehension than lower order decoding and fluency skills. In another study, Budd, Whitney & Turley (1995) examined individual differences in working memory while reading expository texts and discovered that students with lower working memory struggled to answer detail questions of the text but maintained thematic information and were able to answer topic related questions. Students with a higher working memory span in this study increased their thematic processing in order to retain the detailed information, and these students adjusted their strategies to accommodate different tasks and materials. The individual differences among readers' higher order processes were negligible when the task was easier but larger when the reading task was more demanding.

Attention allocation adds another element to higher-order processes for

comprehension. Attention allocation is the ability to adapt attention and processing based on the fluctuating nature of the task. Students who have difficulty with attention allocation may find it difficult to identify structurally-central information in a text and keep this information prominently in focus while reading the text (Rapp et al., 2007). In addition, difficulty with attention allocation may make it difficult for students to self-evaluate and monitor comprehension while reading (Kieffer, Vukovic & Berry, 2013). Further, when attention allocation is not strong, readers may be more distracted by details that are irrelevant to the main ideas in a text (Kendou et al., 2014).

Though working memory and attention allocation are important higher order processes, the ability to make inferences remains a cornerstone of comprehension and is highly predictive of comprehension in general (Oakhill & Cain, 2012; Kendeou, Bohn-Gettler, White, van den Broek, 2008). Inference generation involves both the activation of information from memory and the integration of that information. Inferences may be local, involving ideas close to one another in the text, or global, involving the current text and information no longer in working memory (Trabasso & Suh, 1993). Inferences may be text-based by depending exclusively on connecting ideas within the text, or knowledge-based by connecting textual information and background knowledge (Trabasso & Suh, 1993). Inferences serve different purposes. Coherence inferences establish links between ideas in the text, and elaborative inferences expand a reader's understanding of the text by integrating prior knowledge (Cain, Oakhill, Barnes & Bryant, 2001). Generating inferences is critical for comprehension because comprehension requires readers to fill in information that is left implicit in the text

(McNamara & Magliano, 2009). When readers draw on prior knowledge to fill in gaps in the text, these inferences create a level of representation called the Situation Model, and this Situation Model level of representation is desirable for comprehension because it lasts longer in memory than a text-based representation of reading (Kintsch, Welsch, Schmalhofer & Zimny, 1990). Zinny (Kintsch et al., 1990) studied the decay rate of the Situation Model by examining sentence recognition for different levels of representation of a text over time. For this study Zinny created sentences that reflected the surface level representation of the text (sentence is copied from the text), text-based level of representation (paraphrase), and Situation Model level of representation (integration of background knowledge with text). In this study, subjects read the text and then took the sentence recognition test at one of the following times: Immediately after reading the text, 40 minutes after reading the text, two days after reading the text, or four days after reading the text. The Situation Model was the only level of representation that did not decay rapidly after reading. This study demonstrates the importance of integrating background knowledge with text for learning.

Though the Situation Model is desirable for reading comprehension, students who struggle with comprehension often have difficulty generating inferences while reading (Cain, Oakhill, Barnes & Bryant, 2001). This difficulty may be related to difficulty with the process, such as low working memory, or lack of relevant knowledge in relation to the text (Swanson & Berninger, 1995). Cain, Oakhill, Barnes and Bryant (2001) studied individual differences in inference generation and found that students who struggled with comprehension often recalled knowledge-based information from the text but didn't

know which information would be relevant to integrate for an inference. In a study of predictive inference generation by Linderholm (2002), students with low working memory relied on high causal sufficiency in the text and non-speeded reading conditions to generate predictive inferences. Inferences do not always improve comprehension of texts though. Kendeou, Muis, and Fulton (2011) studied the effect of readers integrating incorrect prior knowledge with the text, and found that integrating incorrect knowledge leads readers to generate incorrect inferences (Kendeou & van den Broek, 2007). Inference generation involves both automatic and strategic processes from readers. The activation of information from memory is considered an automatic process, but the integration of that information can be affected by attention, strategies, and goals for reading (van den Broek, Lorch, Linderholm & Gustafson, 2001).

Standards of Coherence

Students differ in the attention, strategies, and goals they adopt for reading each text, but all students adopt standards of coherence for each text they read (van den Broek, et al., 2011). Standards of coherence are the level of understanding a reader intends to achieve for an individual text, and these standards may be implicit or explicit to the reader (Kendou, et al., 2014). Standards of coherence vary depending on the reader, the text, and the reading situation. For example, a reader's goal for reading and the relevance of the text to the readers' goal influences the readers' standards of coherence (van den Broek et al., 2001). Reading situations, such as the readers' interpretation of instructions or whether students are reading to learn or reading for pleasure, influence standards of coherence (Kendou et al., 2011; Rosenblatt, 1978). Reading situations, such as social,

cultural and institutional factors, influence a reader's standards of coherence for texts (Wilson, Martens &Arya, 2005; Pardo, 2004). Text-related factors, such as content, structure, genre, and difficulty, also influence readers' standards of coherence (van den Broek et al., 2011). Difficulty of text and familiarity with content require different levels of effort, and readers adjust standards based on challenges involved with texts.

Standards of coherence are important to keep in mind when identifying difficulty with reading comprehension because they remind educators that comprehension for individual readers is dynamic and highly contextual. If a reader's standard of coherence is not met while reading a text, secure reader's initiate strategic processes, such as rereading and drawing on prior knowledge, to achieve the desired level of coherence; however, students who struggle with comprehension often do not recognize inconsistent information, draw on prior knowledge, or engage in strategic processes to improve standards of coherence with texts (van den Broek et al., 2011).

Comprehension Instruction

It is common today for teachers to differentiate curriculum and instruction based on individual reader variables; however, differentiating instruction for students who struggle with comprehension presents some challenges. These challenges include knowing how to measure and understand individual student's comprehension and knowing how to intervene when students struggle.

Measuring Comprehension

Comprehension is most often measured in schools as a product and an outcome, and this leads to difficulty understanding where and why comprehension breaks down for

individual readers (Duke & Carlisle, 2011). In addition, comprehension assessments generally lack a connection between the theoretical foundation of the assessment and the validity of the measure (Leslie& Caldwell, 2009). Further, policy that promotes standards and accountability frequently reduces reading comprehension to 'objective' assessments that are easily administered to large groups of students (Wilson, Martens & Arya, 2005). These 'objective' assessments measure narrowly conceived sets of skills and strategies for reading comprehension. Wilson, Martens, and Arya (2005) studied the interaction between instruction and assessment and found that focusing on standardized and numerical outcome scores increased the probability that valuable information about individual students' comprehension was lost. Teachers, who focused on outcomes in this study, developed an incomplete understanding of students' comprehension, and this limited the teachers' instructional approach.

Assessments that focus on process are critical for instructing students who experience difficulty with reading comprehension (Johnston, 2010; Trabasso & Suh, 2009; Leslie & Caldwell, 2009). Process assessments gather online information as students read and provide evidence of students' use of strategies. In addition, process assessments offer insight about the content of information in students' working memory and the building of a student's mental representation of the text (Trabasso & Sue, 2009). By paying close attention to the way students create meaning with texts as they read, teachers have the opportunity to coach students and adjust instruction. Furthermore, process assessments are important because they help readers focus on the act of reading rather than an outcome score (Wilson et al., 2005).

When students believe their struggle is related to a permanent deficit, they lose agency (Johnston, 2010). Assessments must provide information about what the child can do, rather than simply what the child cannot do. Students who may see themselves as struggling readers often assume failure and either act disruptively or invisibly to avoid rejection. Teachers who provide explicit feedback to students about what the child already knows and can already do are better able to scaffold instruction, develop a sense of equity, and promote agency for their students (Vlach & Burcie, 2010). All students bring knowledge to the classroom, and assessments that build on that knowledge are important for comprehension.

Process-oriented assessments must also examine learning and higher-order thinking. When assessments focus on creating meaning, readers who struggle with comprehension improve more than when assessments and learning are skill focused (Allington & McGill-Franzen, 2009; Allington, 2013). When students view reading as an opportunity to learn and to construct new knowledge, they engage more in higher-order thinking than when students believe the goal for reading is literal comprehension (Afferblach et al., 2013). Assessments that provide insight on students' undertaking of challenges, working to monitor and achieve goals, persevering when reading gets difficult, and situating their own experience in relation to what they read, offer important evidence of processes that lead to learning outcomes (Leslie & Caldwell, 2009); Afflerbach et al., 2013). It is important for educators to consider measurement of comprehension because instruction and assessment interact in powerful ways (Fuchs & Fuchs, 2006; Afflerbach & Cho, 2013; Paris, 2005).

Knowing How to Intervene

Interventions are inspired by diverse beliefs and theories about how to best support students who are struggling with reading in schools (Paris, 2005; Pressley, Graham & Harris, 2006; Kraayenoord, 2007: Lipson & Wixson, 2012). These beliefs may conflict with one another as educators apply different theoretical perspectives to the pragmatic goal of increasing student learning.

Potential concerns of current reading interventions. Reading interventions vary between being comprehensive or targeted. Burns and colleagues (Burns et al., 2016) believe that when students struggle with reading, they should receive targeted intervention support in the most fundamental area as long as the core instruction in a classroom is strong. In their study, second and third grade students grew more in words read correct per minute (WRCM) with targeted intervention than comprehensive intervention. By contrast, Wanzek, Wexler, Vaughn and Ciullo (2010) found in their synthesis of reading interventions for fourth and fifth grade students that comprehensive interventions provided larger growth than targeted interventions. When assessing the efficacy of reading interventions, Paris (2005) claims there is no reliable evidence that mastering constrained skills leads to reading proficiency or fruitful reading comprehension. In order to gather a fuller picture of the impact of reading interventions on students, Pressley et al. (2006) encouraged researchers to include a range of diverse measures of growth for literacy intervention research. For example, in a phonics intervention, researchers would collect data on phonics growth along with data on motivation, decoding with connected texts, fluency and comprehension.

Some researchers have raised some concerns about reading interventions (Allington, 2013; Paris, 2005; Van Kraayenoord, 2007). One of these concerns is that interventions can lead to limited curriculum that focuses on isolated skills in an attempt to try to 'fix' the student. When the reader is removed from the act of reading, then segmented tasks are separated from purposeful reading. Students receiving skill-based support are frequently pulled from content area instruction to acquire reading skills. This is problematic because the activation and integration of background knowledge with texts, along with higher order processes of learning from texts is critical for comprehension (Cervetti & Hiebert, 2015).

Another concern with reading interventions occurs when teacher expertise is not valued (Allington, 2013; Lipson & Wixson, 2012). Policies that require teachers to 'use curriculum with fidelity' stand in the way of the teachers' ability to adjust curriculum and instruction based on the individual needs of readers. These policies send the message to teachers that publishers makes wiser decisions about individual readers than teachers in the locality of the readers' classroom. Particularly when working with students who struggle with reading, instruction depends on knowledgeable teachers adapting and adjusting curriculum to fit the reader (Johnston, 2010; D'Ardenne et al., 2013).

A further concern with interventions occurs when the premium on speed and easily measurable skills interferes with comprehension development for students who struggled with reading in schools (Allington, 2013; Van Kraayenoord, 2007). The enactment of No Child Left Behind (No Child Left Behind, 2002) emphasized the teaching of phonics and fluency, and reading materials such as decodable texts and

decoding nonsense words became standard practice at the expense of sense making (Allington, 2013). Reading reformers aimed to make measurable improvements in a short amount of time, and the impact of this reform led practitioners to view reading through measures of accuracy and speed. However, deep comprehension often involves students slowing down to construct meaning with texts (Kucan & Palinscar, 1984), and gains in comprehension, vocabulary, and conceptual knowledge are not easily measured (Duke & Block, 2012; Paris, 2005).

Interventions that focus on reading comprehension. A comprehension intervention that has been used in schools and researched across decades is Reciprocal Teaching (Palinscar & Brown, 1984). Reciprocal Teaching is an approach to comprehension intervention that provides students with modeling and practice for four comprehension-monitoring strategies. Students use these strategies to think carefully about the text and discuss with one another the meaning they are creating. In Reciprocal Teaching, teachers provide feedback as students read by entering the online interaction with texts, and teachers are taught to adjust their participation based on finely tuned understandings of students' ongoing comprehension development. Reciprocal Teaching intends to mimic learning in naturalistic settings, and students take an active role with reading comprehension by utilizing strategies of expert readers. Results from this reading intervention demonstrate clear evidence of improvement in students' dialogue about texts, scores on comprehension tests, transfer of effective use of reading strategies from lab to classroom settings, and maintenance of reading comprehension across time (Liang & Dole, 2006; Palinscar & Brown, 1984).

Wanzek, Wexler, Vaughn, and Ciullo (2009) reviewed twenty-four reading intervention studies and nine of these studies were focused on comprehension interventions. All of the comprehension interventions focused on strategies. These strategies included self-regulated learning strategies to process texts, reciprocal teaching, or work with particular comprehension strategies such as mapping main ideas, asking and answering questions, clarifying unknown words, drawing on prior knowledge and thinking of the author's purpose. Their synthesis of effective comprehension interventions for students who struggled with reading comprehension in the upper elementary grades describes the importance of providing opportunities for students to preview text, connect with their prior knowledge, use self-questioning, self-monitor reading, and summarize what they learn.

Theoretical Framework

Pressley and Afflerbach (1995) synthesized 40 verbal protocol studies and catalogued processes of expert readers based on these studies. Their synthesis led to a theory of reading comprehension called Constructively Responsive reading. A foundational concept in this theory is that reading comprehension is a massively active process before, during, and after reading. According to their view, reading is constructive, in that knowledge is constructed, and also responsive in that readers respond to texts in relation to different contexts. Constructively Responsive reading takes into account many important theories of comprehension processing including Kintsch's (1988) descriptions of text processing, schema theory and the importance of prior knowledge (Anderson & Pearson, 1984), reader response and transactional theory

(Rosenblatt, 1978), comprehension monitoring and metacognition (Baker & Brown, 1984), and making inferences while reading (Cain, Oakhill, Barnes & Bryant, 2001). The theory of Constructively Responsive reading is an important theory for my study because it provides specific processes of expert readers that I use for measuring reading comprehension on the path from the struggling to secure reader.

I also draw on the Landscape Model (van den Broek, Rapp & Kendeou, 2005) for my study. The Landscape Model depicts reading comprehension as a cognitive process that involves a parallel activation of information in the text along with related prior knowledge in memory. According to the Landscape Model, readers move through a text in cycles, and cycles represent either a sentence or proposition. For each cycle, concepts fluctuate in activation based on four sources of information: the current cycle (sentence or proposition), carryover from the preceding cycle, the current representation of the text in memory, and the reader's background knowledge. When information is activated, it spreads across a network and links to related concepts, strengthening conceptual understanding and memory; however, when concepts and ideas are not well connected with prior knowledge or well connected in the text, they drop out of activation.

The Landscape Model provides a theoretical framework for the dynamic interaction of both memory-based processes and constructionist processes. The memory-based process is called cohort activation. Cohort-activation is passive, meaning that readers do not control it. When a concept is activated, other linked concepts will automatically activate because they are linked in memory as a cohort. The constructionist process is called coherence-based retrieval. Coherence-based retrieval is strategic,

intentional, and based on the reader's unique standards of coherence for different texts they read. Standards of coherence assume individual differences among readers' mental representations of the same text based on individual reader's unique criteria for comprehension. The Landscape Model portrays a dynamic interaction between memory-based and constructionist processes, as a reader's standards of coherence can be met automatically through cohort activation, and other times readers will need to actively search the text or background knowledge to reach coherence. The validity of the Landscape Model is based on the correspondence between a reader's predicted behavior in a computational model and observed data.

The Landscape Model provides a theoretical explanation for challenges readers may face while reading. One challenge is that memory-based processes sometimes activate information from a reader's memory that is not relevant to a particular text (Kendou & van den Broek, 2007). When this happens, secure readers draw on strategic processes to fix the inaccuracy and achieve coherence, but developing readers often do not recognize breakdowns in comprehension or engage in strategic processes. Also, readers need to be able to search through their memory of background knowledge or previous parts of a text without getting caught up in less than useful information, and this flexibility of moving between the multiple tasks involved with comprehension can be challenging for developing readers (Rapp et al., 2007). Further, the ability to identify important connections in texts is critical for comprehension, and developing readers have difficulty when connections extend over long distances in the text, are complex, or

require strong background knowledge that does not match the background knowledge of the reader (Rapp et al., 2007).

Concluding Thoughts

Despite the availability of many effective instructional practices, there are students in schools who continue to struggle with reading comprehension. There is more work that needs to be done to improve comprehension interventions and instruction in schools. First, educators need better information about their students' comprehension processes to provide the most effective instruction for students who are struggling. Reading outcome scores give little to no information about why and when a student is struggling. Second, comprehension interventions rarely take into account the strong influence of content familiarity on learning, yet research along with cognitive models of comprehension demonstrate that content knowledge not only lays a foundation for understanding a text, it also influences the way a reader interacts with the text (Brozo, 2010; van den Broek et al., 2005). Third, more work is needed to bridge theory and practice. Research delineates individual differences in comprehension development (Rapp et al., 2007), and cognitive models of comprehension provide valuable information about how readers process texts (van den Broek et al., 2005). This information can be put to use as educators teach students in schools who are struggling with comprehension.

My study addresses these needs by implementing a reading intervention in school that takes into account content familiarity, text difficulty, and authentic purposes for reading. In addition, my intervention implements verbal protocols to focus on comprehension processes in addition to comprehension products. Specifically, my study

seeks to answer the following research questions: In what ways do secure readers and developing readers differ in their comprehension while reading an informational text? In what ways does a group of reading specialists use information from verbal protocols for their instruction? In what ways do content familiarity, text difficulty, and reading for authentic purposes interact with learning? Does reading instruction that takes into account content familiarity, reading for authentic purposes and verbal protocols improve learning?

Chapter 3: Introduction to Methods

My study aims to develop educational solutions for students who struggle to comprehend texts, while at the same time developing theoretical understanding of learning. I ask the questions: In what ways do secure readers and developing readers differ in their comprehension while reading an informational text? In what ways does a group of reading specialists use information from verbal protocols for their instruction? In what ways do content familiarity, text difficulty, and reading for authentic purposes interact with learning? Does reading instruction that that takes into account content familiarity, reading for authentic purposes and verbal protocols improve learning?

Design-based research is well matched for my project because the goal of design-based research is to advance both theory and practice simultaneously by implementing an intervention in naturalistic contexts (McKenney & Reeves, 2012). This is not a small undertaking. Barab (2006) describes design-based research as a "Herculean task of grounding our theory, supporting the development of an innovation, implementing this in a naturalistic context, collecting and analyzing data in rigorous ways, and reporting all of this in a way that will convince others of the value of our work with respect to local impact, and, at the same time, demonstrate its experience-distant value." (p. 166). In this chapter I begin with a description of the origins of design-based research along with defining characteristics for this approach. Then I explain my intervention design by laying out five conjecture maps. After this I provide information about the participants, setting and materials important for my study. Finally I explain my methods of data collection and analysis procedures.

Design-Based Research

Design-based research (DBR) is an emerging approach to research that has grown in popularity over the past two and a half decades since its origin. At its origin, Ann Brown (1992), pioneer of design-based research, engaged in design experiments to answer questions about cognition and learning that could not be satisfied through laboratory-based experiments alone. Brown and colleagues viewed laboratory experiments as insufficient for studying cognition and learning for many reasons including a growing recognition of the importance of context for learning (Brown, 1992; Barab & Squire, 2004), the need to create innovative solutions to problems in schools (Farley, 1982), and the importance of bridging research and practice (Design-Based Research Collective [DBRC], 2003).

Laboratory research was insufficient for studying many aspects of cognition and learning because it lacked context (Collins, Joseph & Bielaczyc, 2009). The social context in classrooms had become an important consideration for learning, and rather than isolate social variables by working with one student in a laboratory, researchers wanted to better understand the influence of social interactions on learning. Scholars moved their research from artificial settings toward naturalistic contexts in an effort to gain a more comprehensive and accurate view of learning in schools (DBRC, 2003). This was an important shift, and researchers discovered that real-life learning was intrinsically entangled with situations and context (Brown, 1994; Barab & Squire, 2004). By studying learning in naturalistic contexts, researchers could consider the complexity involved with learning in classroom settings, the multidimensional nature of learning, and

the interdependence of variables that impact learning (Joseph, 2004; Salomon, 1991; Sandoval & Bell, 2004).

Scholars during this time also recognized the need for developing innovative solutions to problems in schools (Farley, 1982; Brown, 1992). Advocates of DBR wanted to know what problems could be solved in normal, classroom settings, not just in laboratories (Brown, 1992), and this led to the conceptualization of a design to research that focused on both theory and common classroom conditions to promote change (Confrey & Lachance, 2000). In order to study innovation and change within complex school systems, scholars developed conjecture driven approaches to research. Conjecture driven research is open-ended, guided by an inference that is based on theory, and does not have conclusive evidence of its impact (Confrey & Lachance, 2000). By contrast, conventional laboratory research tests a static hypothesis in order to determine whether an intervention worked or didn't work. Conjecture-driven research allowed scholars to study change and transformation of classroom practices. It allowed curriculum to be developed flexibly in response to student learning throughout a research project. The conjecture came to be valued for its ability to provide a robust study without restricting the potential for transformation (Confrey & Lachance, 2000).

By situating research in school settings and focusing on innovative solutions to problems in schools, researchers responded to another important issue. This was the need to bridge research and practice. School practices often did not reflect progress made in research (Brown, 1994; Reinking, 2010). There were several reasons for this disconnect. The research world physically existed in a different space from schools, making

communication of research less accessible. In addition, teachers often questioned the applicability of lab experiments that didn't take into account the constraints of classroom settings. Even when practitioners and researchers developed a common vocabulary around important principles of learning, the transfer of these principles into classroom practices was not being addressed (Brown, 1994). Research was needed to study 'how' laboratory studies and theory could effectively influence learning in the classroom, and researchers and practitioners began to seek a 'usable' knowledge. (Brown, 1992).

The DBR goal of developing usable knowledge is firmly rooted in a theoretical base (Brown, 1992). Theory acts as a guide for conducting DBR research and also acts as a lens with which to interpret the data. Brown (1992) promoted research that was both guided by theory and developed theory because she believed that without understanding theory established in the design, the application of instructional strategies in classrooms would suffer. Other researchers joined Brown in promoting the idea that the marriage of procedural knowledge and theory is critical to create a better bridge between research and practice (Ormel, Roblin, McKEnney, Voogt & Pieters, 2012).

The work of Ann Brown in the 1990s is commonly cited as the beginning of design-based research; however, design-based research is pragmatic, and pragmatism dates back to the work of John Dewey (1929) and also forward as many scholars during the early years of DBR found value in pragmatic approaches to research (Cobb, Confrey, diSessa, Lehrer & Schauble, 2003; Dillon, O'Brien & Heilman, 2000; Eisenhar & Towne, 2003). The pragmatist's goals translate to philosophical foundations of design-based research. In both pragmatism and design-based research, scholars take the position

that the purpose of inquiry is to benefit teacher practice and student learning. In both pragmatism and design-based research, inquiry is dependent on context, locally and socially situated, solution oriented, and collaboratively constructed. In both pragmatism and design-based research, the value of the research is in the development of theory and the usefulness of research to practice.

Design-based research originated in the United States, yet today hundreds of DBR articles are published every year across the world. As design-based research grew in popularity, it also grew in the variety of ways it was implemented. Even though variety is found in DBR approaches, there are converging characteristics that define this approach. McKenney and Reeves (2012) characterize design-based research as being theoretically oriented, interventionist, collaborative, responsively grounded, and iterative. Reinking and Bradley (2008) differentiate between design-based research and conventional methodologies. In their comparison, the operative goal of conventional methodologies is to establish causal relations or generate thick descriptions, whereas the operative goal of design-based research is to put theory to work. Conventional research questions might include "What is best most of the time?" or "What is?" In contrast, design-based research asks, "What could be?" Conventional research focuses on comparison or ideologically-positioned practice, whereas design-based research focuses on modifying an intervention to achieve ecological validity. Conventional research views participants as agents or pawns, whereas design-based research includes participants as collaborative partners. The utility of conventional methodologies is found in broad generalizations or deep

reflections, whereas the utility of design-based research is in the context-specific recommendations that enable effective practices.

Design-based research is still evolving. As DBR evolves to become more formalized with its methods, many researchers believe it is important to allow flexibility in expanding on and refining existing approaches of inquiry (Bell, 2010). Others call for frameworks and infrastructures to facilitate successful development of an initiative that could lead to systemic educational improvement over time (Sabelli & Dede, 2013). For many researchers, the strength of design-based research is found in explanatory power, the grounding of specific experiences, being internally consistent, and considering whether the interventions and theory are well connected and accurately reflect the truth about theory and outcomes in the design (Edelson, 2002). The value of the theory for others is justified by improvements in practice and learning (Anderson & Shattuck, 2012).

As a way to increase the specificity within design-based research Sandoval (2014) suggested conjecture mapping. Conjecture maps establish the embodiment (tools, task structures, participant structures, and discursive practices), mediating processes (observable interactions between participants and the designed environment), and intended outcomes (measurable evidence) of the design (Sandoval, 2004). This process allows the researcher to describe expectations of the intervention and trace how these expectations have or have not been met. Embodied conjectures can be tested, refined or rejected (Sandoval, 2004). Conjecture maps support systematic analysis by linking the embodiment and important mediating processes to expected outcomes.

The Intervention Design

Five conjecture maps guided the embodiment, mediating processes, and intended outcomes for my intervention (Sandoval, 2014). Based on the formative nature of this project, the data I collected throughout the project influenced the intervention design, and some of the conjectures became a primary focus for this intervention while other conjectures received less attention.

Table 4
Conjecture Map 1

Embodiment	**Mediating Processes**	**Outcomes**
Verbal protocols	Make thinking and cognitive processes visible	-Teachers have a better understanding of student processes of comprehension -Students increase metacognition

Using verbal protocols as a formative assessment tool embodied my intervention. Comprehension is often measured as a product and an outcome, and this makes it difficult to understand where and why comprehension breaks down for individual students (Duke & Carlisle, 2011). Comprehension is actually a cognitive process, and by examining process it is clear that readers interact with texts in very different ways (Rapp et al., 2007). For this intervention, students thought out loud during pre- and post-assessments and also as they read texts throughout the intervention. The intended mediating process for verbal protocols was to make thinking visible so that teachers would have a stronger understanding of students' processes of comprehension and students would have increased metacognition about their reading. This conjecture map was a primary focus throughout the intervention and study.

Table 5
Conjecture Map 2

Embodiment	**Mediating Processes**	**Outcomes**
-Content grouped texts	-Activate and build relevant knowledge needed for comprehension -Integrate this knowledge across texts to strengthen conceptual understandings -Navigate structure and text features	-Increased knowledge (facts, vocabulary, concepts, language structures, text features) to draw on for future texts -Stronger mental representation of text.

Second, my intervention was embodied by content-grouped texts. Knowledge supports every part of reading by providing a foundation on which to attach information and also by influencing how students interact with texts (Kendou & van den Broek, 2007). Longer immersion in content allows students more opportunities to activate relevant prior knowledge and integrate this knowledge to strengthen conceptual understandings of text (Gelzheiser, Hallren-Flynn, Connors & Scanlon, 2014). When students read, prior knowledge and text interact in a way that codetermines the acquisition of content learned from texts (Kendeou & van den Broek, 2007). Content-grouped texts provide opportunities for new knowledge to be integrated with known knowledge, important information organized around topics, and conceptual understanding strengthened. In addition, reading in a content area allows students to use organization of text structure features to retain more information from the text (Kendeou & van den Broek, 2007). These mediating processes provide students with opportunities to develop strong mental representations of content area texts. For my project, students

read about raptors for three weeks, and wrote about raptors the fourth week. This conjecture map was also a primary focus throughout the intervention and study.

Table 6
Conjecture Map 3

Embodiment	**Mediating Processes**	**Outcomes**
Content grouped texts gradually increase in difficulty	-Lay foundation of understanding -Knowledge compensates for difficulty -Link knowledge and concepts	-Raise standards of coherence - Create a coherent mental representation of grade level text -Recall idea units in retelling of grade level content area text

Third, texts gradually increased in difficulty based on content familiarity and text difficulty (Graesser, McNamara & Kulikowich, 2011). Content knowledge has a scaffolding effect for information in memory, helping developing readers compensate for difficulty (McNamara & Kinstch, 1996). Beginning with the most accessible text encourages readers to establish a strong foundation of knowledge on which to attach new information encountered in reading (Trabasso & van den Broek, 1985; van den Broek et al., 2001). For my project, students first read a text about eagles, and according to the Coh-metrix dimensions of text difficulty (Graesser et al., 2011) the grade level rating for the first text was 2.9. Texts gradually increased in difficulty throughout the project ending with a text about falcons. According to Coh-metrix dimensions of text difficulty (Graesser et al., 2011), the grade level rating for the falcon text was 5.2. By rating each text based on grade level and five dimensions of text difficulty the reading specialists and I studied the interaction between text difficulty and comprehension. Though we considered dimensions of text difficulty, this conjecture map received less attention during the study.

Table 7 ***Conjecture Map 4***		
Embodiment	**Mediating Processes**	**Outcomes**
Read for authentic purposes	-Connect text to participants' world outside of the classroom -Direct attention during reading to goals and finding valuable information	-Increased interest and relevance for reading -Build real world knowledge

Fourth, my intervention was embodied by authentic purposes for reading. When readers have goals and purposes for reading, their standards of coherence, attention and focus change (van den Broek et al., 2011). Standards of coherence impacts meaning that is created from the text. Students may focus on different parts of the text as relevant or read with different standards of coherence (van den Broek et al., 2001). When readers have an authentic purpose for reading, their engagement and conceptual understanding of texts increases (Duke, Purcell-Gates, Hall & Tower, 2006; Halvorsen, et al, 2012). For my intervention, students read a book about an eagle taken to the University of Minnesota Raptor Center. I explained to students that they would be learning a lot about raptors from their reading over the next three weeks and invited them to consider creating a book about raptors the fourth week of instruction that would be put in the children's area of the raptor center. In turn, the University of Minnesota Raptor Center would provide certificates for each student with a free family tour pass to the raptor center. The intended mediating process for creating a book about raptors and giving students an opportunity to visit raptors at the University of Minnesota Raptor Center was to increase

purpose for reading by connecting learning to the students' world outside of the classroom. The intended outcome for this project was that students would experience increased relevance and interest in learning from texts. This conjecture map also received less attention during the study.

Table 8
Conjecture Map 5

Embodiment	**Mediating Processes**	**Outcomes**
Mystery texts	-Make thinking visible -Fill gaps in text cohesion with relevant prior knowledge -Review content read	-Teachers have a better understanding of student processes of comprehension -Students increase metacognition and inference making skills -Students' increase their use of active and strategic thinking statements on verbal protocols

Fifth, my intervention was embodied by the use of mystery texts. Mystery texts are short texts (up to 7 sentences) that begin with general information and add detailed facts each succeeding sentence. Students discussed their thinking after each sentence presented. Mystery texts encouraged students to fill in gaps in text cohesion with prior knowledge. They also provided teachers with opportunities to focus instruction based on a deeper understanding of individual student's comprehension processes (Smith, 2006). Thinking out loud has been used successfully in interventions to engage students in the process of making text-based and prior-knowledge inferences (Kucan & Beck, 1997; Smith, 2006). Students in my project read mystery texts 2-3 times a week during the first three weeks of my intervention and also created their own mystery text the fourth week for their book about raptors. This conjecture map was a primary focus throughout the intervention and study.

Methods

For my project, I examined verbal protocols as a formative assessment tool used by reading specialists as they worked with fourth grade students in an intervention setting. In addition, I studied the influence of content familiarity, text cohesion, and authentic purposes for reading on student learning. My study draws on the Landscape Model (van den Broek et al., 2005) and Constructively Responsive Reading (Pressley & Afflerbach, 1995) to see how theory interacts with learning in the context of practice. The Landscape Model (van den Broek et al., 2005) provided support for teachers to identify important cognitive processes needed for students to successfully comprehend text. In addition, this model guided teachers in how to coach students with comprehension processes. I referred to the theory of Constructively Responsive Reading (Pressley & Afflerbach, 1995) to identify strategic behaviors before and after the reading intervention and to measure students' growth.

Participants and Setting

Design-based research is intentionally collaborative, and conducted with practitioners whose practical knowledge, expertise, and understanding of the problem at hand is valued and used to design theoretically based solutions to educational problems in schools (McKenney & Reeves, 2012). I designed this project to be implemented in schools to study comprehension development related to instruction for students currently struggling with reading comprehension. Students in the study received 30 minutes of focused reading instruction in a pull out setting in addition to the core classroom instruction. Core instruction differed in schools and within classrooms across the district.

Some teachers approached the reading block as a workshop model, while other teachers chose to ability-group students and send students to different classrooms for their reading instruction. The curriculum purchased by the district for core instruction was Houghton Mifflin (Cooper, Pikulski & Chard, 2006). Book clubs replaced Houghton Mifflin as the core instruction for all students three times during the school year for two weeks each time.

Reading Specialists. There were six reading specialists who participated in this project, and all reading specialists worked within one Midwestern suburban public school district. Student enrollment for this school district was approximately 8,300 students with 19% percent of the students reporting minority status, 3.4 % receiving English Learner services, and 9% of the students receiving free and reduced price meals. The number of students who graduate from the high school is 99%, and 94% of the students pursue some sort of higher education. There are six elementary schools in the district, and a full time reading specialist was hired for each of the elementary schools. The reading specialists' primary role during this project was to work with students who qualified for Tier 2 level of intervention along with providing some leadership to the reading programs at the schools. All six of the reading specialists at the time of the project are female, Caucasian, and hold both an Elementary Education license and a Reading Specialist license. Each of the reading specialists had worked in their position at the school for a minimum of 5 years before this project.

The reading specialists' roles for my project varied in how they interacted within my study. One of the reading specialists consulted with me about the design of the

project, two of the reading specialists provided the control group of students and helped me coordinate assessments and permission forms, and three of the reading specialists worked closely with me as co-teachers and co-researchers throughout the project. I would describe the close collaboration with these three reading specialists as both clinical partners and co-learners (Wagner, 1997). At each of the three schools, the reading specialists and I co-taught lessons, each took field notes, drew on our combined knowledge of reading to make formative decisions, and reflected together on the interaction between instruction and learning throughout this intervention. Reading specialists provided valuable perspectives about how my intervention influenced the students at their schools in a different way then they had seen before. In addition, reading specialists considered how the Landscape Model of reading (van den Broek et al., 2005) informed their understanding of the cognitive processes of their students, and they also used this model to drive their own instruction. I was fortunate to draw on the expertise of this group of educators as we worked together to study the interaction of theory and practice.

Students. Each of the reading specialists worked with student participants. The experimental group included a total of 11 students (9 fourth grade students and 2 fifth grade students) from three separate reading groups at three different schools. The control group included a total of 10 students (8 fourth grade students and 2 fifth grade students) from two different schools. All of the student participants were eligible for and received intervention services based on district guidelines. These district guidelines qualified students for extra support based on scores that fell below the 40% on the Measures of

Academic Progress (MAP) assessment (Northwest Evaluation Association, 2003) I reviewed the students' scores before the study began and confirmed that all of the students in the study met this guideline. In addition, data from the Qualitative Reading Inventory (Lauren & Caldwell, 2006) corroborated the identification of these students for intervention services. None of the students qualified for special education services. The experimental group consisted of 4 females and 7 males. Eight of the students are Caucasian, one student is Somali, and one student is Black. The control group included 5 females and 5 males. Eight of the students are Caucasian, one student is Hispanic, and one student is Black/White.

In addition to the above-named groups, 3 fourth grade students formed the secure group for this study. Fourth grade teachers in one of the schools recommended students for the secure group. I reviewed the students' NWEA data over the past two years to confirm the identification of this group of secure readers. Each of the students in the control group scored consistently above the 70% in reading on the NWEA standardized assessment for the past two years. The secure group included two males and one female. Two of the students are Caucasian, and one student is Hispanic.

Materials

I selected trade books and a website for the students' reading materials. To accommodate the needs of the district, one of the texts came from the school district's intervention curriculum Soar to Success (Cooper & Chard, 2008). The Soar to Success text was about falcons and led to my choice of raptors as the topic for reading. I selected eight trade books and purchased enough copies for each of the 11 students in the

experimental group. Three of the trade books were about eagles, three of the trade books were about owls, and two of the trade books were about falcons. Students also read from a portion of the University of Minnesota Raptor Center website called *Meet Our Birds* (2015). I selected texts based on three goals. First, I chose texts about raptors. Second, I chose a variety of informational texts that represented different structures and increasing levels of text difficulty (Graesser et al., 2011). Interestingly, the text that came from the intervention curriculum was above grade level according to Coh-metrix, so that became the final trade book in the intervention. Texts ranged from a 2.9 grade level to a 5.2 grade level, though portions of the *Meet Our Birds* website were rated an 8th grade reading level. Third, I chose texts that were high quality and I believed would be engaging and interesting to the students.

I adapted two texts to assess students' comprehension before and after the intervention. Students read the text *Let's Learn About… Hawks* (Sartori, 2014) for the written response to text assessment. Students read the text *Raptor! A kid's guide to birds of prey* (Laubach & Smith, 2002) for the verbal protocol assessment. I adapted both of these texts to fit the text difficulty needs of the research project, and this meant that I sought to achieve a text difficulty level between 4th and 5th grade according to the Coh-metrix dimensions of text difficulty (Graesser et al., 2011).

To keep students' materials organized, I gave each student a folder that held lined paper for writing, a sheet with prompts to support thinking or writing about texts, and a raptor guide to identify raptors found in the Midwest. In addition, I created mystery texts for students to read. Mystery texts are short texts (5-7 sentences) that began in a general

manner and became more specific. Mystery texts reviewed content and allowed teachers to look carefully at what students were thinking and how students were integrating information across a text.

I created the curriculum for this intervention based on theories, research, and the principles outlined in the conjecture maps. Each of the three reading specialists who instructed students received this curriculum in the form of a binder. The binder included 20 days of lessons. Each day included a purpose statement for the lesson, introduction to the text, modeling of thinking processes, guided and independent reading coaching prompts, guided and independent writing prompts, and opportunities for students to talk together about their thinking. I explained to the reading specialists that this curriculum was not a script, it was meant to provide guidance without being restrictive. I encouraged reading specialists to make ongoing changes to the curriculum based on our findings, and we did this throughout the project. The binder also included an overview of the study, all of the mystery texts, a list of texts labeled by difficulty level, and the conjecture maps. At the back of the binder I provided paper for field notes. A sample day of the curriculum is placed in the appendix along with the assessments and mystery texts.

Data Collection and Analysis

My study addressed research questions before, during, and after the intervention. I collected and analyzed based on these questions. See Table 1.

Table 9.

Data Collection Matrix based on Research Questions

Research Questions	Background knowledge	Written Response to text	Verbal Protocols	Retell	Field notes	Conversations and Emails	Audio recordings	Summary Notes
In what ways do secure readers and developing readers differ in their comprehension while reading an informational text?	x	x	x	x				
In what ways does a group of reading specialists use information from verbal protocols for their instruction?					x	x	x	x
In what ways do content familiarity, text difficulty, and reading for authentic purposes interact with learning?	x	x	x	x	x	x	x	x
Does reading instruction that takes into account content familiarity, reading for authentic purposes and verbal protocols improve learning?	x	x	x	x	x	x	x	x

My intervention followed a formative design, and I used the data collected throughout to make instructional decisions.

Background knowledge. I first assessed students' background knowledge during the students' regularly scheduled 30 minutes of small group learning time at each of the five schools in the study. Each student was prompted to write up to five things they already knew about raptors. Students received a point for each statement they wrote that accurately described something they knew about raptors. I assigned a background

knowledge category to each student. The categories included: No background knowledge- if a student did not write anything accurate about raptors. Low background knowledge- if a student wrote 1 or 2 accurate statements about raptors. Moderate background knowledge- if a student wrote 3 or 4 accurate statements about raptors. High background knowledge- if a student wrote 5 or more accurate statements about raptors. The purpose of this assessment was to consider how background knowledge might influence comprehension of texts on the pre- and post-assessment data. In addition, the reading specialists and I made instructional decisions based on the background knowledge assessment. For example, we prompted kids with no or low background knowledge to talk about what they learned as they read about raptors, and when students didn't draw on their background knowledge to help them understand the text, we prompted students to make connections between their background knowledge and the text.

Written Response to Text. After students wrote about their background knowledge, I asked each of them to silently read a small book called *Let's Learn About… Hawks* (Sartori, 2014), that I had adapted to fit the text difficulty standards of this project. When students finished reading the text about hawks, they were given a sheet of paper with five questions to answer. Students were not allowed to look back at the text to answer the questions. The purpose of this assessment was to understand how students' comprehension and memory of the text impacted the product of their reading. In addition, I learned which types of questions were the most challenging for students to answer. For this assessment, I wrote one literal question, two inferential questions, and two

engagement questions. I evaluated students' written responses to the text by assigning points for each question they had answered correctly. See Table 2 below.

Table 10.
Students' Written Response To Text

Question	Question Type	Points
1. What is a raptor? Give at least three characteristics.	Literal	3
2. Why is a healthy hawk population important for humans?	Inferential	2
3. What can humans do that would be helpful to hawks?	Inferential	2
4. What quality of a hawk do you find the most impressive? Why is this impressive?	Engagement	2
5. What was something you learned about hawks that was especially interesting to you?	Engagement	1

The accuracy in student's response to the text was important. The answer to the literal question, "What is a raptor? Give at least three characteristics." was explicitly written in the text. Students received a point for each of the three characteristics about raptors that were written in the text. A correct answer written by a student that received three points was *Raptors have big eyes, sharp talons, and a hooked beak.*

The answer to the second and third questions required students to draw on background knowledge or integrate information across the text. Question 2 asked: Why is a healthy hawk population important for humans? A correct answer written by a student was: *The reason healthy raptor population is good because scientists use hawks for measuring animal population.* Question 3 asked: What can humans do that would be helpful to hawks? A correct answer written by a student was: *Humans can do to be helpful is that they can stop polluting the environment with deadly chemicals to hawks.* Inferential questions were worth two points because they required students to integrate

two sources of information. Students were assigned one of the two points if they wrote an answer that could be considered correct but was not well integrated with the text. For example, a response to Question 3 that received one point was: *Not hunt hawks*. Though this student identified a way humans can avoid causing harm to hawks, the text didn't have information about humans hunting hawks. Rather, the text informed readers about ways humans cause harm to hawks such as changing the environment so quickly that animals can't adapt fast enough, unintentionally poisoning hawks through pesticides, or hitting hawks with a car. By failing to draw on the content in the text, but answering the question in a way that was not completely inaccurate, students received one of the two points.

The answers to the fourth and fifth question were coded as engagement because these questions reflected a personal response to the text. Question 4 asked: What quality of a hawk do you find the most impressive? Why is this impressive? A correct answer written by a student was: *Their eyesight because even though they can only see black and white they have really good eyesight and can see 8 more times than the best seeing person ever!* Question 4 was worth 2 points because students needed to describe a quality of a hawk that was impressive and also tell why they thought this was impressive. Students lost a point for Question 4 if they answered the first part of the question but failed to tell why this was impressive. In addition, students lost one point if they repeated the exact same answer in Question 4 and 5. Question 5 asked: What was something you learned about hawks' that was especially interesting to you? A correct answer written by a student was: *That a hawk can fly up to 150 miles per hour to dive for prey.* Question 5

was worth only one point because students only needed to write one idea that they learned from the text. I listed points for each type of question in a table and calculated averages for each type of question for students in the secure group, experimental group, and control group.

Verbal Protocols. On a separate day, I met individually with each of the students in a quiet room and audio recorded a total of 196 minutes of students' verbal protocol statements. Verbal protocols have been used for hundreds of years to reveal thinking (Pressley & Hilden, 2004). Much of what we know about processes of comprehension today has come from verbal protocol studies (Pressley & Afflerbach, 1995).

Ericsson and Simon (1993) wrote a foundational text for verbal protocol analysis called *Protocol Analysis: Verbal Reports as Data.* I followed their methodological recommendations for collecting data. According to Ericsson and Simon (1993) verbal protocol analysis does not require training, but some students benefit from an explanation and model. So, I provided an explanation and model of how to think out loud while reading a text before the verbal protocol assessment. Specifically, I explained to students, "Strong readers think a lot as they read. It's like a conversation in our heads. When you are aware that you are thinking something about your reading, I want you to say what you are thinking out loud." Then I modeled for students how I was thinking about my reading using one of the pages from the hawk text. I provided the same explanation and model for all of the students in the study. Also, Ericsson and Simon (1993) recommended that researchers slow down automatic processing during reading. In my study, if students read in an automatic mode and didn't share any thinking statements out loud within a

paragraph, I prompted students at the end of a paragraph to share their thinking out loud. In addition, I prompted students to share their thinking with an open-ended prompt because open-ended prompts lead to richer theoretical understanding. Further, I prompted students to share **what** they were thinking rather than **interpret** or explain their thinking because I wanted to access the thinking in students' short-term memory. Short-term memory is a more accurate reflection of students' processing than long-term memory (Ericcson & Simon, 1993). The prompt I provided readers was, "What are you thinking?" I used this prompt during the pre-instruction phase of verbal protocols an average of 3 prompts per student for the control group, an average of 2.7 prompts per student for the experimental group, and an average of 2.3 prompts per student for the secure group. Verbal protocols were important for this study because they showed the amount of thinking, types of thinking statements, and delineated the cognitive processes for each of the students in the study.

I audio recorded and analyzed 196 minutes of students' verbal protocol statements. First I transcribed the audio recordings, and this led to 40 double-spaced pages of full transcripts. Six of these pages of transcripts represented the thinking statements of secure readers, 16 of these pages represented the thinking statements of developing readers in the control group, and 18 of these pages represented the thinking statements of developing readers in the experimental group. Next I examined each thinking statement on the transcript compared to predetermined categories for secure readers, adapted from Pressley and Afflerbach's (1995) Theory of Constructively Responsive Reading, and I assigned each of the student's statements a category. The only

statement that was not assigned a category was, *"I'm not thinking anything right now,"* and this statement occurred only once during the verbal protocol assessment. After I assigned each statement to a predetermined category, I differentiated between two types of thinking statements: statements that involved an integration of information either between background knowledge and text or within the text, and statements in which the student responded on a text-based level (Fletcher & Chrysler, 2009). I made this distinction after studying my verbal protocol data and realizing that developing reader statements and secure reader statements differed based on this front. In addition, I added a category-unclear statements or inaccurate interpretations- to provide a space for statements that were found in my data but were not listed as part of expert reading through Constructively Responsive Reading (Pressley & Afflerbach, 1995). The predetermined categories are listed in Table 3 below.

Table 11.
Predetermined categories for the Verbal Protocol Assessment with the Raptor Text

Text-based statements	Paraphrase Affective response to text Ask a question about text content Monitoring
Integration statements	Relate text to prior knowledge Inference Prediction/Substantiate on prediction Identify inconsistent information in text based on expectations Critical/evaluative stance
Inaccurate statement	Unclear statement/inaccurate interpretation

This table represents statements made for secure and developing readers. These categories provided a way for me to analyze data, and they also provided a way to measure change in verbal protocol statements between pre- and post-assessments.

Retell. After each individual student finished reading and sharing their thinking statements about the raptor text (Laubach & Smith, 2002), I turned over the text and asked students to think back to the beginning and retell the text in the order they remembered reading. I audio recorded each student's retelling, and transcribed these data. To analyze the data consistently, I assigned a point to each idea in the raptor text, and gave students points for each idea they recalled in their retelling of the text. The total number of points possible in the retelling of the text was 26. To receive 26 points students would need to retell every sentence they read by memory, so 26 points was not the goal for the retelling. I did not assign points for telling the story in order, but I did write about the order of the retelling in note form and attached these notes to the retell points for each student. See the appendix to view the raptor text and point values used for the retelling assessment. My purpose for examining students' retelling of the text was to assess how well the text was represented in students' memory. Retell data were important for this study because they allowed me to consider the ways student's processing of text through verbal protocols led to their representation of the text in memory.

Field Notes. Each of the three reading specialists took field notes of their observations during instruction. At times reading specialists took field notes as I taught a lesson, and other times reading specialists paused their own teaching for a moment to jot down a note they wanted to remember. Field notes represented reading specialists'

observations related to instruction, individual student's difficulties with comprehension, and observations of growth made by students throughout the course of the intervention. In addition, field notes included theoretical comments made by reading specialists as they considered the implications of their observations in relation to learning and instruction. I also took notes of my own observations at the end of most of the days of instruction. These field notes combined to include 46 pages of data. I analyzed these data by looking for trends and themes in field notes across all three sites and among the reading specialists. Including three experimental sites in the study allowed me to triangulate data related to the implementation of my intervention, and when all three reading specialists separately wrote about the same observations related to instruction and learning in our project, this gave me confidence that their observations were representative of more than a local interaction with the intervention.

Conversations and emails. Because of the collaborative nature of this project, I was able to spend a few minutes most of the days of the week discussing observations of instruction and learning from the reading specialists. I valued this opportunity to learn from what reading specialists noticed about their students' learning, challenges related to comprehension processes, and thoughts and suggestions related to the instruction in this intervention. I also sent frequent emails to the reading specialists asking for their feedback and thoughts along the way. I collected 215 emails across the time span of two months and used these emails as data for this study. Emails were important because of the formative nature of the project and helped drive instruction.

Summary notes. I asked reading specialists to provide a summary of their reflections midway through the project and another summary at the end of the project. These summaries led to 20 pages of data that I used to look for themes across sites. The summary notes also led me to triangulate data related to the reading specialists' observations of student learning, instruction, and the challenges students were facing related to comprehension development. By considering summary notes, field notes, and conversations and emails across three sites, I was able to identify and code data by common themes.

Audio recordings of two lessons. I audio recorded two coaching sessions on two separate days at one of the school sites to study coaching processes, language, and the impact of this coaching on student learning. I audio recorded 44 minutes of teacher coaching and transcribed portions of the audio recording to analyze the coaching that was part of the reading specialists' lessons.

Timeline

Design-based research is a collaborative, formative approach to research. My collaboration with the reading specialists began before the intervention was implemented and continued after the intervention had been completed. Table 12 displays the timeline of my project adapted from the core phases of design-based research presented by McKenney and Reeves (2012).

Table 12.
Timeline for Project

Timeline	March 2015- December 2015	January 2016- March 2016	March 2016- May 2016
Outputs	-Establish initial theoretical framework -Develop the initial intervention design	-Instruction -Investigate theoretically principled ideas in practice	-Evaluate the effectiveness of the intervention design -Design principles
Activities	-Literature review -Problem analysis -Exploration of problem in collaboration with reading specialists	-Implement -Collect data -Analyze data -Collaborate -Refine and revise	-Analyze data -Synthesize findings -Revisit literature -Collaborate with reading specialists on implications
Cycle	-Informed exploration (Preliminary investigation)	Enactment Analysis Evaluation Retrospective	Evaluation Analysis Retrospection

I first met with the reading specialists in March 2015 to ask for their feedback on the need for a formative assessment for comprehension and the need for a new approach to comprehension instruction for students who struggle with comprehension. At this meeting I shared my previous research using verbal protocols with secure and developing readers, I shared the Landscape Model (van den Broek et al., 2005) as a theoretical approach to comprehension, and I asked reading specialists if they wanted to collaborate with me on this research project. The feedback from the reading specialists affirmed the direction I was heading, and each of the reading specialists agreed to work collaboratively with me on the project. I met with reading specialists three more times before the intervention began to collaborate on the design of the intervention and answer

questions they had. In January 2016, we began collecting permission forms for research, and by the end of January we implemented our intervention. Table 13 displays the timeline for the implementation of the intervention.

Table 13.
Timeline for the Implementation of the intervention

Dates	Participants	Micro-cycles	Enactment
January 19-January 29	-Experimental group -Control group -Secure group	Pre-assessment data collection	-Background knowledge assessment -Written response assessment with hawk text -Verbal protocol and retell assessment with raptor text
February 1-5	Experimental group	Week 1 of instruction	Reading and thinking about eagles
February 8-12	Experimental group	Week 2 of instruction	Reading and thinking about owls
February 17-February 24	Experimental group	Week 3 of instruction	-Reading and thinking about falcons -Reading about raptors on the University of Minnesota Raptor website
February 24-March 2	Experimental group	Week 4 of instruction	Writing about raptors and creating a raptor book
March 3-March 14	-Experimental group -Control group -Secure group	Post-assessment data collection	-Background knowledge assessment -Written response assessment with hawk text -Verbal protocol and retell assessment with raptor text

Micro-cycles of enactment of the intervention enabled the reading specialists and me to make formative decisions throughout the project. After collecting and analyzing pre-assessment data, I met with each of the reading specialists from the experimental group and shared data about their individual students along with a summary of data from all of the students I assessed. Together we made instructional decisions about the

intervention based on this pre-assessment data. Each week of instruction functioned as a separate micro-cycle of enactment because the design of the intervention included the same instructional strategies across the weeks. The reading specialists and I refined our instructional approach each week based on our findings, making instructional decisions across micro-cycles of enactment. After collecting post-assessment data, we met together again to discuss the findings and talk about implications for practice.

Conclusion

Lab research often takes 40 years to influence classroom practice, and frequently 'what research says' has been replaced by entrepreneurial enterprise that repackages research to create commercial reading programs that are not representative of the original research (Allington, 2013). An advantage of design-based research is the immediate impact the research has on practice. Reading specialists in this study gained a formative assessment for comprehension and new instructional approaches that they used with students immediately during and after of our study. In addition, by putting theory to work in the context of practice in classroom spaces, design-based research provided an opportunity for us to refine theory and use it in new ways.

Chapter 4: Findings

The purpose of my study was to develop a stronger understanding of how to support developing readers in the area of comprehension. Specifically, through this study I examined verbal protocols as a formative assessment tool by working alongside a group of reading specialists as they used information from verbal protocols for their instruction. In addition, I studied the influence of grouping texts by content area. Research in the area of comprehension, along with models of cognitive processing, both point to the strong influence of background knowledge for comprehension. Rather than focusing on skills and strategies in isolation, my instructional approach was to group texts by content area. The first week, students read three books about eagles. The second week, students read two books about owls, and the third week, students read a book about falcons and read about raptors on the University of Minnesota Raptor Center website. The fourth week, students created a book about raptors that was given to the University of Minnesota Raptor Center. I used texts across this study that varied in text difficulty to study how text difficulty interacted with developing reader's comprehension.

Phase 1: Pre-instruction Assessments

This project was formative in nature. The data that I collected before and during the project influenced how the reading specialists and I proceeded through the project, and this influenced our findings. I begin this chapter with assessments collected before our instruction.

Data Sources

Two weeks before we began instruction for this project, I met with each of the students in the study to collect pre-instruction data. First, I collected data during students' small group instruction time with reading specialists. I asked each student to write up to five things he/she already knew about raptors. Then students independently read a hawk text and wrote answers to five questions. On a separate day I met in a quiet room with each of the students independently and asked them to read a short text about raptors while prompting students to think out loud. After students read the text about raptors I asked them to retell what they remembered reading.

Findings

I collected pre-instruction data for three main purposes. First, I wanted to establish a baseline of data for students in the control group, secure group, and experimental group so that I could compare pre-instruction and post-instruction data between these groups of students. Second, I was interested in learning how secure readers approached texts compared to students who had been identified as needing reading support. Third, I wanted to plan instruction based on what the data showed about the students in the experimental group.

High engagement and interest in reading. Students in each of the groups displayed high levels of engagement and interest in their reading. Unlike the students in my previous verbal protocol studies, all students in this study shared thinking statements when prompted, and many students shared thinking statements without a prompt while reading the text. There was a difference in the number of thinking statements made

between secure and developing readers. Secure readers provided twice as many statements as developing readers. Secure readers shared an average of 19 statements while reading. The control group shared an average of 7 statements, and the experimental group shared an average of 10 statements.

All students in the study demonstrated interest and engagement in their reading as they wrote about the hawk text. I measured student engagement by analyzing students' written responses to the following questions about the hawk text: What quality of a hawk do you find the most impressive? Why is this impressive? What was something you learned about hawks that was especially interesting to you? All students in the study were able to answer these questions. Secure readers averaged 2.6 out of 3 points for these questions; the control group averaged 2 out of 3 points; and the experimental group averaged 2.17 out of 3 points. These scores imply that students paid attention to parts of the text that they found interesting. Though low engagement can be an obstacle to proficient reading comprehension, in particular for students who have not had a lot of success in reading, the students in this study appeared engaged and ready to learn.

Difficulty with literal and inferential thinking. All of the students scored very well on the engagement portion of the hawk text, scoring at least 2 out of the 3 points on the above listed questions and providing thinking statements while reading during the verbal protocol assessment. Nonetheless, there were large differences in scores between the secure and developing reader groups in both literal and inferential thinking. I measured literal understanding on the hawk text by analyzing students' written response to the following question: What is a raptor? Give at least three characteristics. The hawk

text explicitly told readers the three characteristics of raptors and also provided information about each of these characteristics on separate pages of the book. Yet, of the 20 developing readers in the study, 15 of them scored a 0 for this literal understanding of the text, and 3 of the students scored a 1. These scores indicate a difficulty among the developing readers with literal comprehension of texts, and this differed from the secure readers who scored an average of 2.34 out of 3 points in response to the literal question for the hawk's text. I measured inferential understanding on the hawk text by analyzing students' written responses to the following questions: Why is a healthy hawk population important for humans? What can humans do that would be helpful to hawks? Answers for the inferential questions on the hawk text differed between the secure readers and developing readers. Developing readers scored an average of 1.23/4 for inferential comprehension, but this contrasted with the secure readers who scored an average of 3.6/4 on their ability to integrate information across and within this text. The students' scores on the hawk text indicate that students may be interested and engaged in learning but struggle to remember and integrate information in the text.

Decoding challenges and comprehension challenges. As I studied the data collected during the verbal protocol assessment it became clear to me that individual students among the developing group differed in their challenges with reading. To better understand this difference, I compared decoding and retell averages between the developing readers and secure readers. The secure group of students read the raptor text accurately, fluently, and with many think aloud statements. They read with an average of 99.5% accuracy in decoding and scored 7.5 points on the retelling of the text. By

contrast, developing readers' scores split between accuracy and retell points. The 4 **most accurate decoders** of text, among the developing reader group, read with an average of 99.5% accuracy for decoding and an average of 4 points on the retell of the text. By contrast, the 4 **least accurate decoders** of text, among the developing reader group, read with an average of 92% accuracy for decoding the text, and an average of 7 points on the retell of the text. This data describes unique challenges students may face in the area of comprehension. Though challenges with decoding may have impacted students' comprehension of text, it is interesting to note that students who were putting a lot of effort into their decoding, and struggled to read the text fluently, remembered about the same amount of the text as the secure readers. Whereas developing readers, who read the text fluently, effortlessly, and with accuracy in decoding at a level similar to the secure readers, found it difficult to retell the text and talk about what they had just read. Students differed in their challenges with decoding and comprehension.

Difference in the number of words spoken. One of the most significant differences between the secure and developing readers was in the average number of words spoken during verbal protocols. The developing group spoke an average of 134 words during verbal protocols, whereas the secure readers spoke an average of 344 words during verbal protocols. This difference in the number of words spoken between these groups points to a potential difference in the amount of conscious processing of the text and the likelihood that secure readers processed more information as they read than the developing reader group.

Difference in the type of thinking statements. As I compared statements made by secure and developing readers, I found differences in the average length and type of thinking statements made between these two groups of students. The following data set, taken from transcripts of verbal protocols with developing readers, captures examples of typical statements made by developing readers.

"That's not a pleasant thought at all."
"Like what animal it would be."
"That's creepy."
"Wow!"
"What does that word mean?"
"I would think that it's cool they evolved over millions of years."
"I wonder what small animal they are talking about."
"I wonder if it means capture, like in a cage."

The average developing reader statements were short and often showed an emotional reaction to the text. As developing readers processed the text they frequently asked a question about the content in a particular sentence or paraphrased the sentence they had just read. The typical developing reader statements generally fell into some of the pre-determined categories adapted from Pressley and Afflerbach's (1995) Theory of Constructively Responsive Reading including: *Paraphrase, Affective Response, Ask a Question About Text Content*, and *Monitoring Text*. When considering all the statements made by developing readers, 49% of developing readers' statements fell into one of these categories. It is interesting to note that these categories describe responses to text that are focused on a text-based, literal understanding of a particular sentence.

These statements contrasted with the typical thinking statements made by secure readers. The statements below are taken from transcripts of the secure group of students reading the same passage as those gathered from the developing readers noted previously.

> *"Well, yeah, that would be very scary because if you're surviving in the wild and you're in the food chain, not even that close to the top, yes, you would be afraid something's watching you that you couldn't see yourself."*

> "*Yeah, in the book that I read it said scientists use them to track populations of animals and see how the environments going out there because they can't all measure it by themselves. You need something, a nature resource, that goes around all the time."*

> *"So when I read that, I think this might be an owl because I'm pretty sure they have really good hearing."*

The average statements made by secure readers were longer than average statements made by developing readers and often showed an integration of information between background knowledge and the text. This integration of information between the readers' background knowledge and text can be seen in the first example as the reader draws on his prior knowledge of the food chain and the challenges of surviving in the wild to better understand what it would be like to be watched by something that you couldn't see. In the second example, the reader connects information he had just learned from the hawk text in order to draw a conclusion about the way raptors keep the natural world in balance. In the third example, the reader makes an inference by drawing on both text clues and prior knowledge about an owl's hearing. When placing secure readers' statements in some of the predetermined categories, adapted from Pressley and Afflerbach's (1995) Theory of Constructively Responsive Reading, secure reader

statements most often fell into the pre-determined categories of: *Relating Text to Prior Knowledge, Making Inferences, Making Predictions, Substantiating On Predictions, Identifying Inconsistent Information In The Text Based On Expectations,* and *Evaluation.* These pre-determined categories all involved an integration of information across the text or between the text and the reader's background knowledge. Eighty-six percent of the secure readers' statements fit best in these categories.

Accurate versus inaccurate statements. Developing readers did integrate some information with the text as they read; however, I coded many statements as inaccurate or an unclear interpretation of the text. The following statements are taken from transcripts of verbal protocols from developing readers while reading, and these statements are examples of developing readers' integration with the text that resulted in an inaccurate understanding of the text.

Example 1*: "I'm thinking that this group of birds sounds even more scarier than the first."*

This statement was coded as an inaccurate interpretation of the text because the student did not seem to recognize that the text was only talking about one group of birds. This student struggled to see the way ideas in the text were connected across the text. This statement demonstrated a pattern of responses among developing readers that showed students had an unclear understanding of how parts of a text fit within the whole text.

Example 2*: "I'm thinking, I'm thinking, that I should hide in the dark."*

This student had just finished reading the part of the text that explained that a raptor will find you if you hide in the dark. This student's desire to escape from the raptor was stronger than his acceptance of what the text was telling him about raptors. This statement demonstrates a pattern of responses where the students ignored what the text said in an attempt to fulfill their own personal wish.

Example 3: *"Well then like, if they would be in the city like, then I would think I should go somewhere else than the city."*

This student did not connect the previous sentence to this sentence. The previous sentence explained that no matter where you live in North America, a raptor is living nearby. When the student read the sentence about the raptor living in the city, his main focus was to get out of the city without considering that raptors were all around him in the countryside too. This difficulty integrating one sentence to the next sentence was also a pattern in the data.

Example 4: *"That if we don't have raptors everybody could die."*

This student overgeneralized the meaning of the text, and this led to an inaccurate interpretation. The text stated that raptors were necessary to keep the natural world in balance, but this did not mean that everybody could die if raptors died. The student's inference lacked accuracy. This pattern of over-generalizing the information in the text was evident in many of the developing readers.

Processing Challenges. Verbal protocols also revealed that many developing readers had difficulty with attention and focus. Five of the eleven students who were part of the experimental group got lost multiple times while moving between talking about the

text and reading the text during the verbal protocol assessment. In addition, the same students accidentally skipped lines of text as they read, and some of the students used their finger to help them track the print when they realized they were struggling to keep focused on the text. Further, a number of developing readers required wait time to gather their thoughts before speaking, and many developing readers appeared to have an idea in their head that they were working hard to communicate. The following statement comes from a transcript of verbal protocols from a developing reader.

> *"Well, if, um, then I would just run, like and make it tired cause then, cause they, it wouldn't want to chase, like, go after me anymore. Wait where was I?"*

In this example, the student appears to be gathering his thoughts and self-correcting his speech as he worked to communicate his thinking. He stopped and restarted explaining his idea a couple of times, switched vocabulary words to try to communicate his idea, switched pronouns, and in the end the student was lost in the transition between his thinking and the task of reading. The effort this reader put into processing his thinking was a pattern in the data among many developing readers.

Content grouped texts influenced students' processing. The Landscape Model (van den Broek et al., 2005) provides a conceptual framework for the cognitive processes of comprehension, and this framework helped me and the reading specialists better understand individual student's processing of text. The Landscape Model describes reading comprehension as a co-activation of information from memory along with the words on a page, and this co-activation spreads and links to form conceptual understanding of texts. The Landscape Model describes both memory-based and

constructionist processes that are interconnected and dynamically interact in the act of comprehension.

The memory-based process in the Landscape Model (van den Broek, et al., 2005) is referred to as cohort activation. Cohort activation assumes that concepts link to related concepts to form a cohort. When an individual concept in a cohort is active, other concepts related to it are also activated. I saw evidence of cohort activation when students included information from the text they read on Day 1 about hawks while retelling what they remembered reading from the raptor text on Day 2. For example, when Kelly finished reading the raptor text, and I prompted him to retell what he remembered reading, he described the raptor as having *a razor sharp beak that can tear through skin*. These words were not in the raptor text he was retelling, but they were the exact words used to describe the hawk's beak in the text from the day before. In addition, James described how raptors *are not fussy eaters* and will eat whatever they can get their claws on. These were the exact words used to describe hawks' eating habits in the text James read on Day 1, though James was retelling a separate text about raptors on Day 2. Further, as Dan retold what he remembered reading from the raptor text, he said that raptors *are one of the few birds that can see in color*, and the *hawk's eyesight is the best in the entire animal world*. It's interesting to note that Dan used the exact words found in the hawk text from Day 1 as he retold the raptor text on Day 2. When students read about raptors, this content activated linked concepts in the student's memory from their reading of the hawk text on a previous day.

The constructionist process in the Landscape Model is referred to as coherence-based retrieval. Coherence-based retrieval is a strategic mechanism readers use to search for meaning in the text. According to the Landscape Model, as students search for meaning they adapt a standard of coherence based on their goal for understanding that particular text. I saw evidence of coherence-based retrieval in the student's verbal protocols and retelling of the raptor text.

> Example 1: *"Wait, so the raptor is the same thing as a hawk, so… they have really good eyesight too."*

In this example, Laura is searching for meaning about raptors by drawing on content from the hawk's text to enrich her understanding of raptors. Laura consciously put effort into making this connection between the content in two texts, and this supported her comprehension.

> Example 2: *"It's probably like a bird, because it said hook and bill, like that bird we read about on Tuesday. So when it said raptor, it's talking about the bird we read about on Tuesday."*

In this example, Titus integrated information intentionally between the hawk he read about on a previous day and the raptor text he was currently reading. As Titus tried to make sense out of this raptor, he searched for understanding to achieve his standard of coherence for that part in the text.

More than half of the students in the developing group of readers made a statement during verbal protocols or their retelling of the raptor text on Day 2 that included content from the hawk text read on Day 1. Sometimes the overlap of this content

between the two texts supported comprehension, and other times it led to an inaccurate interpretation. When readers consciously integrated knowledge between texts as part of coherence based retrieval, they generally developed a stronger understanding of the text. In both of these cases, cohort activation and coherence based retrieval; there was an effect to grouping texts by similar content.

Baseline Date. The data I collected before the intervention began provided information about the students' comprehension that could be used to compare growth at the end of the project, and these data also provided information about the differences between secure and developing readers. Table 14 displays these baseline data:

Table 14.
Pre-instruction Baseline Data Averages

Averages	**Secure Readers**	**Control Group**	**Experimental Group**
Decoding	99.3	95.3	96.8
Verbal Protocols: Number of words spoken	344.3	119.8	139.6
Verbal Protocols: Number of inaccurate statements	0	1.56	2.45
Verbal Protocols: Number of text-based statements	2.67	3.1	5.27
Verbal Protocols: number of statements that integrated information	16	2.1	2.63
Number of points on retell	10.3	6	4.4
Total points on hawk text	8.7/10	4.1/10	3.8/10
Hawk text-Literal Response	2.3/3	0.2/3	0.5/3
Hawk text-Inferential	3.6/4	1.3/4	1.16/4
Hawk text-Engagement	2.6/3	2/3	2.17/3

From these data I learned that secure readers are capable of answering all of the questions in the hawks text, are very active in their processing of texts, integrate information between prior knowledge and the text, integrate information across the text,

and do not make inaccurate statements while processing the text. In addition, I learned that though there were some small differences between the control group and the experimental group, both the control group and the experimental group were fairly similar in profile compared to the secure group.

Phase 2: Instruction Phase

As the reading specialists and I headed toward the implementation phase of the reading intervention, I made changes in the original curriculum based on the data I had just gathered. First, I reduced the number of modeling of thinking statements. Before collecting pre-instruction data, I had assumed that a goal would be related to engagement, and I would want to help students with their processing by thinking out loud as they read; however, pre-instruction data showed that students were already providing thinking statements as they read and showed a lot of interest in learning from the texts. Second, I focused more on helping students consider big ideas in the text and integrate information across the text. Verbal protocols, along with the assessment of the hawk text, revealed that students in the developing group were less likely than the secure group to be aware of how pieces of the text fit together. To support students with this integration of information across the text, I planned for students to reread one of the texts each week with a focus on identifying the big idea in the text and rereading to see how pieces across the text supported that big idea. Third, I had originally planned for students to write daily reflections about their reading. Though students did spend time writing about their thinking, we did less of this than I had originally planned. Many of the developing

readers struggled to put their thinking in writing, and with a limited time to meet with students, I cut back on the amount of writing.

Data Sources and Analysis

I collected data during the instruction phase of this project. Reading specialists and I took field notes during instruction, we discussed our observations at the end of lessons and through emails, reading specialists wrote summary notes of their reflections part way through the project and also at the end of the project, we audio recorded a couple of our classes, and I looked through the students' work.

Findings

The following section describes findings related to our analysis of data from the pre-instruction phase of this project along with ongoing decisions made based on data collected throughout the instruction phase of the project.

Verbal protocols as a formative assessment. Reading specialists implemented verbal protocols as a formative assessment tool for reading comprehension with a high level of diagnostic interpretation about individual student's difficulty with comprehension. Based on the prompt, "What are you thinking?" all three reading specialists were able to identify where and why reading broke down for individual students. In field notes and written reflections, reading specialists wrote notes about what they observed and were working on with individual students based on verbal protocols, such as the following.

> *Prompt Mary to expand her thinking to understand the big idea of the passage. She stops on her own to tell about her thinking without being prompted. She doesn't connect to prior knowledge too often.*

Jason is trying to make connections but off.

Ian gets lost in his thoughts and loses focus easily. He needs to be prompted to stay connected with the text. Maybe asking him to think aloud after shorter pieces of text can help him focus. When he stays focused, he generally understands what he has read.

Nancy needs extra time to process before answering questions, and she can give unrelated answers. Does language impact her comprehension?

Darleen is able to understand text better than I previously thought. Listening to her think aloud showed that she usually grasps the big idea, but her struggle comes from her difficulties with unknown words.

These data show that reading specialists used verbal protocols to better understand individual student's comprehension processes and unique challenges with texts. In addition, reading specialists worked to identify an instructional approach to support the unique challenges these students faced. In all three schools, verbal protocols provided reading specialists with a better understanding of each student's comprehension processes. In less than two weeks, reading specialists felt that they had learned a lot of important information about their students. Reading specialists wrote about this in their summary notes.

Think alouds have given me the best insight I've had at where each student's comprehension is breaking down.

I feel like, just asking the open ended question of "What are you thinking" while a student is reading opens up huge insights into the thought processes that lead to understanding a text. When we wait until after the entire text has been read to ask about the story, we may find out what they remember, but not the processes that they are using to pick out the information. So instead of just saying-they don't get it, or it is too hard for them to read, we as the instructors know exactly what pieces of the process they are missing.

> *…listening to what is going on in their heads leads us down the right path- not a subscribed curriculum that has never met the student.*
>
> *I also think that students like having someone listen to their thoughts while reading and make comments or suggest things rather than just quizzing them at the end. It seems more caring but also more intimate to understanding all that the student is thinking. The students got the feeling that they were really working on becoming stronger readers and that the teachers cared about that.*

Reading specialists were enthusiastic about verbal protocols as a formative assessment for comprehension. They felt that verbal protocols gave information they wanted to know about their students, and they were eager to share what they learned with classroom teachers. In addition, it was easy to implement verbal protocols as a formative assessment. As each student read the text independently, reading specialists simply moved around the table to sit next to a student and asked that student to read and think out loud while the other students continued reading independently. If students didn't share any thinking by the end of a page, reading specialists provided the prompt, "What are you thinking?" and students shared.

Coaching students with their thinking. After learning that the reading specialists and I could identify where and why comprehension broke down for individual students, we talked about the need to coach students with their processes. We referred to the Landscape Model (van den Broek et al., 2005) to support both our identification of student's difficulty and our coaching of students' processes based on identified challenges. According to the Landscape Model, readers use four sources of information to process texts. These sources of information include text input in the current sentence, carryover from the preceding sentence, the current understanding of the text as a whole,

and the reader's background knowledge. Based on this model, we created prompts to coach students at a point of difficulty and put together the following table as a tool to support our coaching. On the left hand side of this table, we listed the types of errors we saw students making when they thought out loud. To the right of each error we listed prompts that we began using to coach students with their thinking about the text. We first prompted students to share their thinking with the simple prompt, "What are you thinking?" Table 2 displays our follow up prompts.

Table 15.
Coaching students with comprehension processes

1-If students show difficulty processing text input in the current sentence:	
Students may…	**Prompt:**
Have difficulty pronouncing a word.	Read that sentence again, think about what's happening in the story, and see if you can figure out what _____ means.
Skip or misread an important word.	Read that sentence again and be careful to read each word…. Now what are you thinking?
Ask a question about something that is literal and can be found in the text.	Read that sentence again and see if you can find your answer in the text.
2-If students show difficulty integrating information from one sentence into the next:	
Students may…	**Prompt:**
Think aloud is not integrated between sentences or is missing important information.	Read these two sentences and look for clues in these sentences that tell you more about _____.
Students are stuck on a thought, and they are not paying attention to text information that is inconsistent with that thought.	Read this sentence again and look for clues to tell you more about _____.
Difficulty with pronoun	What is _____ referring to? How do you know?
3-If students show difficulty integrating current representation of text:	
Students may…	**Prompt:**
Thinking shows evidence that the student is not integrating the big idea in the text with the current sentence.	-How does your thinking connect with what you already know about _____? -What do you think is the main message so far in the text? How does _____ fit that main message?

	-How does your thinking connect with the heading _____ in this informational text? -What's the author trying to tell us? -Try to visualize what you think the writer means but isn't saying. -What do you think is the main problem and how does what you just read connect to that main problem?
4-If students show difficulty integrating prior knowledge:	
Students may…	**Prompt:**
Students are consistently only paraphrasing the words they just read	-What do you know about that? Have you ever experienced anything like that? How does that help you understand what's happening in the text? -How does this part of the text connect with something in your life?
Students draw on prior knowledge but it is taking them away from the meaning in the text.	-Reread this sentence and think… how does what you know help you understand this sentence? -How does what you know about _____ fit with what this sentence says or is happening in the story? -What do you know now that you didn't know before? -How can you use this information?

With careful observation of the statements students made, reading specialists deepened their understanding of how to support individual students with their processing of text. Each of the reading specialists began using these prompts with their students, and they shared their enthusiasm and thoughts about this coaching with me through emails, conversations and written summaries.

> *I LOVE THIS!!! This sums up the different observations we have seen, and gives us a common language to follow-up with to prompt or redirect the type of thinking needed to understand what is happening at that moment in time in the text, and in their processing. I am already starting to use this language in working with other groups of students too. They really give great insight into what the child is thinking and how to help them move forward in their comprehension development.*

The framework you are creating reminds me of the Prompting Guide in the Leveled Literacy program. However, the difference is that the F and P is limited and involves much more teacher direction and teacher talk. We are leading their thinking. In your model, your prompts are based on the gaps we see as the child thinks out loud. Then we direct them on what to do to help guide that thinking into something that fits within the Landscape model of reading. We don't solve the need for them. We observe the need and prompt to guide them in finding more clarity and connections with the text. With the goal of having them internalize this and apply to all of their reading.

Once think alouds have been used to determine patterns in thinking and breakdown in comprehension, the verbal protocols can be used to individualize instruction and focus/ and allow teachers to coach students in their meta-cognitive processing of text.

One of the reading specialists was explicit in letting students know what she noticed about each student's processes of comprehension and what each student could do to improve. As we talked about individual student's needs, she reminded me that this explicit explanation for students was important if we wanted students to internalize their learning and carry over this coaching to their reading in the classroom and at home. I audio recorded two of our lessons during which we were both coaching students with their reading. The following transcript demonstrates how we used the four sources of information, based on the Landscape Model, to coach individual students with their comprehension processes while reading texts. During this lesson, students were reading a text called *Falcons Nest on Skyscrapers* (Jenkins & Lloyd, 1996). This text is about the survival of falcons as a species.

Example 1: In this first example, a student mispronounced a word while reading. Through verbal protocols the reading specialist and I noticed that the placement of

commas was keeping this student from using context clues to understand the word eyases.

Here is the portion of the text the student read:

> **Text:** The DDT made the peregrine's eggshells too thin. When the mother falcon sat on them, they broke. No baby falcon, or eyases, could hatch.

Coach: What does the word eyases mean?
Student: I don't know.
Coach: Try rereading this sentence and use clues in the sentence to help you think what the word eyases means.
Student: No baby falcon, or eyases could hatch. (Student reads the sentence without pausing for the last comma, and this changed the meaning of the sentence.)
Coach: Listen to me read this sentence and watch how I read with both commas. No baby falcon, or eyases, could hatch. What do you think the word eyases means?
Student: A baby falcon?
Coach: Yes, how do you know?
Student: Because it tells you in the sentence.
Coach: Yes, the commas interrupt the sentence to tell you another word for baby falcon. I like the way you listened and watched the commas to help you understand that word.

Example 2: In this second example, the student paraphrased a portion of the text in the form of a question. Through verbal protocols the reading specialist and I noticed that the student was not integrating information from one sentence into the next.

Here is the portion of the text the student read:

> **Text:** Falcons are remarkable birds. They are the fastest most skillful hunters on earth. Smart and sleek, beautiful and proud, falcons have been admired for thousands of years.

Coach: What are you thinking?

Student: I'm thinking why they were admired for thousands of years? (This student paraphrased the text.)
Coach: Why do you think they were admired?
Student: Um…. Because…. I don't know.
Coach: Reread these couple sentences and see if you can find why they were admired.
Student: Falcons are remarkable birds, they are the fa.. Ohh. Because they are the fastest, and they're skillful hunters, and they're smart and sleek.
Coach: Yes, the text told us these great characteristics about falcons in this sentence of the text. That makes sense that that's why they would be admired. I like the way you pulled those ideas together.

Example 3: In this third example, the student struggled to connect what was happening near the end of the text with the big idea throughout the text. The student read that the falcons will survive, and he missed the significance of this moment in the text.

Here is the portion of the text the student read:

> **Text:** The office people named Scarlett's mate Beauregard. The falcons took turns sitting on the eggs to keep them warm. After four weeks, the chicks began to pip through their shells. Soon the parents had four hungry eyases to feed.

Coach: What are you thinking?
Student: How they just hatched and they need to find food. (Student paraphrased. Can this student integrate this portion of the text to the big idea of the text?)
Coach: So you said on this page that the baby falcons have hatched. What does that mean considering what's going on at this point of the story (turns to earlier page)… that the chicks have hatched?
Student: That they are now real parents? So they have children now.
Coach: And… how does that fit to this part of the text?

Student: Well, they're trying to find mates?

Coach: So why are they trying to find a mate?

Student: So that they can have a good life?

Coach: When you said they're trying to find a mate, that's based on the picture clue. Can you look at the text and reread a part of this and try to connect your thinking? They are giving us clues here at why this is important.

Student: They were near extinction.

Coach: Yes. Where do you see that?

Student: (Points)

Coach: So what is happening then?

Student: That they just got more babies so that they're not going to go into extinction.

Coach: You're right. That's what I was thinking too. And you used the text to connect your thinking. You looked back and used the words, not just the pictures.

Example 4: In this fourth example, the student is coached with his prior knowledge to better understand the text.

> **Text:** Suddenly the falcon aims and dives straight down at 200 miles per hour! This dive is called a stoop. After striking its prey, the falcon circles back, grabs the falling victim with hook-like talons, and carries it off to eat. The entire capture takes less than a minute.

Coach: What are you thinking?

Student: That 200 miles per hour is faster than a Ferrari can go at full speed. That's crazy.

Coach: That's good that you make a connection that makes sense to you in how to interpret that. What else are these words telling you here?

Student: That um, that this this whole capture of swooping around, grabbing prey takes less than a minute, but that's actually pretty crazy, because not all of them go for this strategy of getting food. Some of them just go straight at them.

Coach: Who goes straight at them? (Reading specialist has been working with students to be more specific since pronoun use has led to confusion.)
Student: I know owls do. They go straight for the neck.
Coach: You're taking the text that you read other days and your connecting it to this, and it's really helping your understanding. Now you know how a falcon hunts different from an owl. That's a great connection to make. Good job.

These coaching sessions reveal the importance of listening to students read and think about the text. It is common practice in upper elementary school for students to read silently and then write their responses to questions. Yet, when students are at the end of the text, it is difficult to know how to support individual student's comprehension. As reading specialists listened to their students think out loud, they were able to identify patterns of difficulty and coach students with comprehension processes.

Mystery texts supported comprehension development. The reading specialists and I found that mystery texts were valuable for working with comprehension processes. Mystery texts are 5-8 sentences in length and required students to integrate information across the text and draw on content knowledge learned from reading. Mystery texts began in a general way and became more specific until the mystery was revealed in the last sentence. As each sentence was shown, students discussed with one another the meaning they were making from the sentence and the ideas they were integrating. The following reading specialist's field notes exemplified a common finding across the study.

> *It is interesting to me that when doing the* mystery texts *students can be so sure of an answer that is wrong even though the information is right in front of them in the book. For example, for the* mystery text *where the answer is the owl's ears, two of the students in the group were adamant that the answer was the eyes of the owl. Even at the end they had to look it up and re-read to make sure of the*

answer. It leads me to wonder if they read generally and then stop thinking since they think they know the information they are reading about.

This reading specialist's reflections revealed an observation that was seen at each of the three schools through the use of mystery texts. Students over-generalized and ignored important clues in the texts once they thought they knew the meaning. In response, reading specialists provided focused coaching; helping students pay more attention to pronoun use, coaching students to integrate information across the text and with their prior knowledge, raising student awareness to important details in the sentences, and reviewing content the students had just read. We also sent an explicit message to students through mystery texts, and that message was that thinking changes as we read. Readers might begin with a general idea about what is happening in the text, but as they add more information, this changes what they think and know.

Mystery texts were a highly engaging activity for students. Some of the students told me this was their favorite part of our project. I think mystery texts let students recognize how much they had learned from reading, and they were motivated to draw on this new knowledge to solve the mystery.

Grouping texts by content area supported learning. All three reading specialists saw a benefit to grouping texts by content area and wrote about this in their mid-point and final summary notes. The following texts were taken from reading specialists' summary notes.

I was a little surprised at how much the students in my group loved to come and work on this unit. They would leave lunch early to get there so they would not miss any part of it. At first it was something new, but I came to realize that they were motivated by consistency of the texts and realizing that they were carrying

information that they felt confident about over to a new text.

All 3 students benefited from thematic reading. They frequently made connections to build meaning from one text to another. They inferred things in a new book, based on their understanding of a previous book.

When students read from texts that overlap in content, they have more opportunities to integrate information as they read. We considered this an instructional advantage to our project. As texts increased in difficulty across the study, students were able to draw on vocabulary they had learned in an easier text. For example, when students read the word 'owlet,' they thought this meant a baby owl because the week before they learned that an eaglet was a baby eagle. Also, in learning that an eyrie was an eagle's nest, students could apply this new word to their understanding of a falcon's eyrie. At the end of the study, one of the students, Jana, reflected with her reading specialist on what she had learned about herself as a reader, and the reading specialist audio recorded this reflection to share with me. Jana talked about reading content grouped texts. She said, "It helped because now we're doing a project on it and it's like 'Oh, I remember this, and Oh, I remember that one, instead of having to be like, okay I don't understand, now I understand it."

Students were motivated by the project-based nature of this study. The first book students read was about a baby eaglet that is taken to the University of Minnesota raptor center. After reading this book I asked the students if they would like to create a book about raptors that we could give to the raptor center to put in the children's area. For three weeks we read about raptors, and the fourth week each student created a page for the book based on what they learned from their reading. In response, the U of M

raptor center created certificates to give to the students with free passes for their families. Students periodically talked about the book they were going to create with great anticipation. Reading specialists wrote about the benefits of the project-based approach in their summary notes.

> *… having a purpose that is real- like the book, provides incredible motivation.*
>
> *They also loved the idea of having an end product- the book and visiting the raptor center.*

Not only did the project-based nature of this study provide motivation for the students, it connected what students read to something in their natural world. The students watched for raptors around their community, and they were going to visit the University of Minnesota Raptor Center. At least one of the students didn't realize that I was a reading teacher; he thought I was a raptor expert coming to teach them about raptors. Reading provided students with opportunity. Content matters, and showing students that reading leads to new knowledge and opportunities based on that new knowledge is important, particularly for developing readers.

Text difficulty varied. I designed our curriculum with a variety of levels of text difficulty, and based these levels on Coh-Metrix (Graesser et al., 2011), which is a computer analysis of text difficulty. Coh-Metrix analyzes texts based on five dimensions of cognitive processes of comprehension: word concreteness, syntactic simplicity, referential cohesion, causal cohesion, and narrativity. I began the study with the easiest level of text difficulty and gradually increased in difficulty across the project.

The reading specialists and I found that students varied in the way text difficulty impacted comprehension. A few students reflected difficulty with comprehension

consistent with the Coh-Metrix analysis of text difficulty. For these students, sentence complexity and unfamiliar multisyllabic words slowed their reading and led to confusion. One of the reading specialists wrote about this in her summary notes.

> *Two students had trouble when reading the harder text Bald Eagles knowing that an eerie was a nest-even after reading the details about the eeries. It seemed like they were boggled down with all of the other information about nests… that they didn't know specifically what they were reading about.*

In another example, Maya read a text with fluency and expression and a lot of think aloud statements until the last paragraph during which she struggled to decode unfamiliar and multisyllabic words. When I prompted her to share what she was thinking at the end of this paragraph, Maya said, *"I don't know. I'm not really thinking very much right now."* It was clear that Maya faced comprehension challenges related to unfamiliar vocabulary, decoding multisyllabic words, and the density of information in higher levels of text difficulty. In addition, Maya would retell easier portions of a text, and forget portions of the text that had more difficult vocabulary.

Although text difficulty, based on Coh-Metrix, impacted some developing readers' comprehension, there were many students who struggled to decode multisyllabic words and still talked about the text with strong understanding. Evidence of this is found in the comparison of decoding and retell data among developing readers. The students who scored the lowest on decoding and struggled to read multisyllabic words were able to talk about what was happening in the text during verbal protocols. These students accurately identified the big idea of the text, integrated information, and remembered what they read during the retell of the text. This group of readers understood text despite the higher levels of difficulty.

We found that text structure impacted students' comprehension. Many of the developing readers struggled with focus and attention allocation, and the structure of the text made it difficult for these students to pay attention to what they were reading. The following field notes describe this difficulty.

> *Text difficulty-Seems like texts that jump to new content frequently are more difficult for students to understand and read… Higher levels of distraction… Even when Cohmetrix listed grade level higher, students retained more information on difficult text that didn't jump around as much. Informational text, when dense with information that is not well connected, was harder for students to remember or talk about.*

These field notes describe a common observation among many of the developing readers. We noticed that students who had difficulty with attention allocation struggled to gain meaning from both the digital reading about raptors on a website and an informational text that frequently jumped topics. Students who had a hard time staying focused while reading loved to click links and jump from page to page. They skimmed pages, looked briefly at the pictures, and it was a challenge to get these students to stay on a page long enough to read the words. During verbal protocols, these students shared very little about what they were thinking from these two texts. By contrast, texts that stayed on the same topic for a longer amount of time helped these students learn from the text. Highly connected text supported comprehension for students who struggled with attention allocation.

Phase 3: Post-instruction Phase

At the end of our month of instruction, reading specialists and I had gained a deeper understanding of individual student's reading comprehension processes. Our

collaboration led to a new formative assessment that was being used along with coaching prompts to support comprehension development. Students were excited about what they learned about raptors and the book they had just made to give to the raptor center. It was time to find out if there was a difference between our experimental group and the control group.

Data Sources

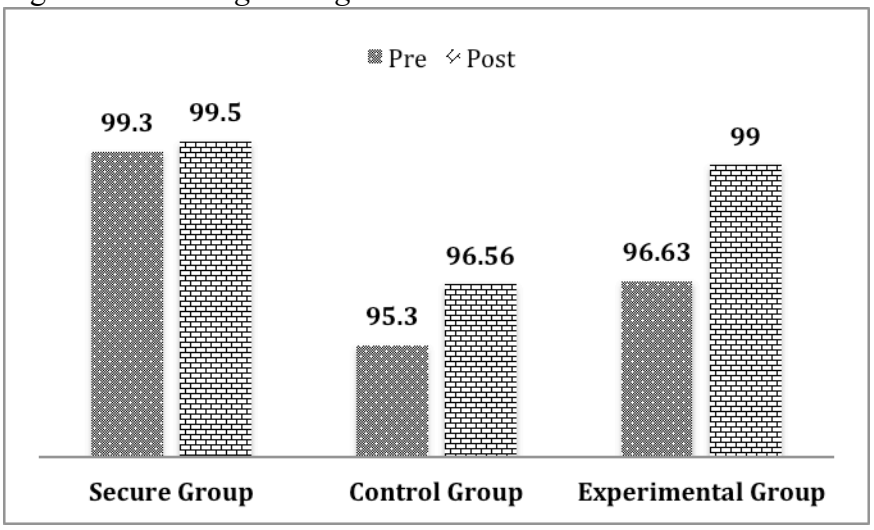
I followed the same procedure for post-instruction assessments as I did for pre-instruction assessments. First, students in each of the five schools wrote up to five things they knew about raptors, read the book about hawks, and wrote responses to questions about the hawk text. Then, on a separate day I met each student independently in a quiet room and asked them to read the same raptor text and think out loud. After students finished reading the text and thinking out loud I asked them to retell what they remembered reading about the text.

Findings

Findings from the post-assessments did show a positive response to our instruction. In particular, our instruction influenced decoding, number of words spoken during verbal protocols, types of statements made during verbal protocols, retell of the text, and literal and inferential responses to questions on the hawk's text. I will present each of these findings separately.

Decoding averages increased. Figure 1 below shows the pre-instruction to post-instruction shift in decoding averages while reading the raptor text for the verbal protocol assessment.

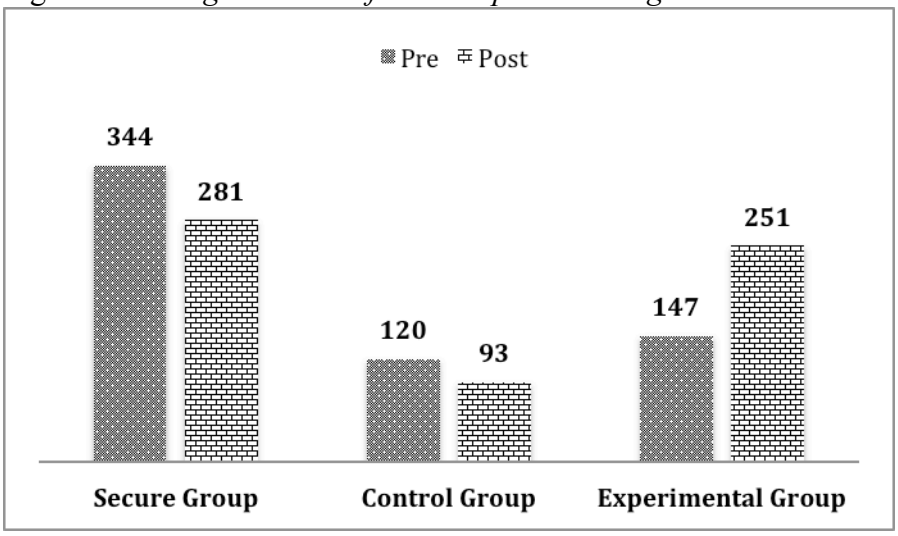
Figure 1: *Decoding Averages*



This chart illustrates that all of the groups increased the accuracy in their decoding between the pre- and post-assessments, but the experimental group increased the most. In fact, there was little difference between the experimental group and the secure group in decoding averages at the end of our study. It's interesting to note that we did not work on decoding as part of our reading instruction. These data point to the influence of content familiarity related to decoding and also the influence of focused coaching of students with their reading based on information gained about students from verbal protocols.

Number of words spoken during verbal protocols increased. The largest amount of growth between pre- and post-instruction assessments came from the number of words spoken by the experimental group. Figure 2 below displays the differences in the average amounts of thinking statements made by the Secure Group, Control Group, and Experimental Group.

Figure 2: *Average Number of Words Spoken during Verbal Protocols*

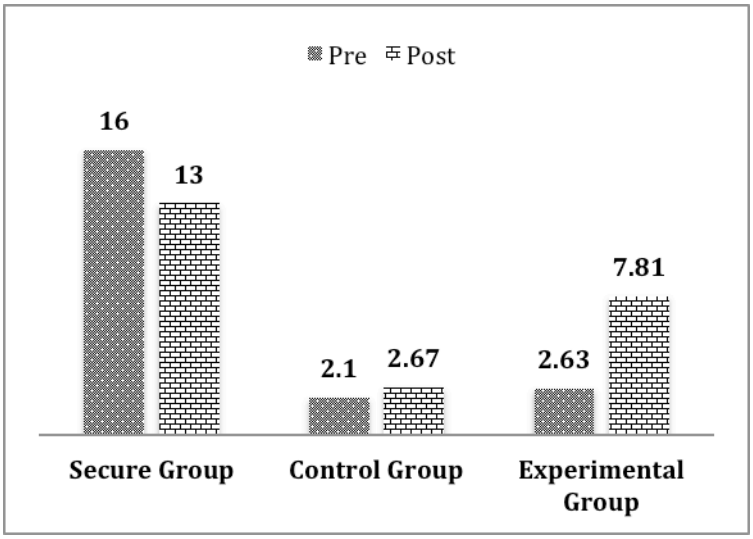


This chart demonstrates a 41% growth in the number of words spoken for the experimental group that was not seen in the secure group or the control group. The experimental group produced an average of 104 more words per student between the pre- and post-assessment data. In addition, the experimental group average number of words for the post-assessment data was only 30 words different from the secure reader post-assessment data. The increased number of words spoken in the experimental group show that the intervention influenced students' thinking about the text. This growth cannot be attributed to the number of prompts students received during this assessment. The secure group received the least amount of prompts with an average of 1.67 prompts during the pre-instruction assessments and no prompts at all during the post-instruction assessments. The control group received the most prompts with an average of 3 prompts during the pre-instruction assessments and an average of 3.4 prompts during the post-instruction assessments. The experimental group received an average of 2.7 prompts during the pre-instruction assessments and an average of 2.8 prompts during the post-instruction

assessments. Though prompts supported students in thinking about the text, the secure readers shared the most thinking with the least number of prompts, and the control group shared the least amount of thinking with the most prompts. Also, the number of prompts this group received could not explain growth in the experimental groups' number of thinking statements between pre- and post-assessments. These data point to the possibility that coaching students with reading processes based on information gained from verbal protocols along with building content knowledge by reading content grouped texts increase cognitive processing while reading.

Students increased the number of integration statements made. When considering the type of statements made by each group of readers, we found that the experimental group grew in the number of statements they made between the pre-instruction and post-instruction assessments that integrated information within the text and across the text. See Figure 3 below.

Figure 3: *Verbal Protocols-Average Statements of Integration*



This chart shows growth in the experimental group that was unique compared to the secure readers and the control group. During the verbal protocol post-assessments, the students in the experimental group shared more inferences, related text content to prior knowledge, made predictions, and substantiated those predictions as compared to their pre-instruction assessments. I coded these statements as integration statements because they moved beyond reacting and responding simply to what a sentence said. The average number of integration statements per student in the experimental group during pre-instruction assessments was 2.63 statements, whereas the average number of integration statements per student during the post-instruction assessments was 7.81. It is also worth noting that **all** students in the experimental group grew in the number of statements that were coded for integration of information.

Figure 4 and Figure 5 below show how this integration of information increased for the students in the experimental group between pre and post assessments.

Figure 4: *Experimental Group- Pre-project Verbal Protocol Averages for Raptor text*

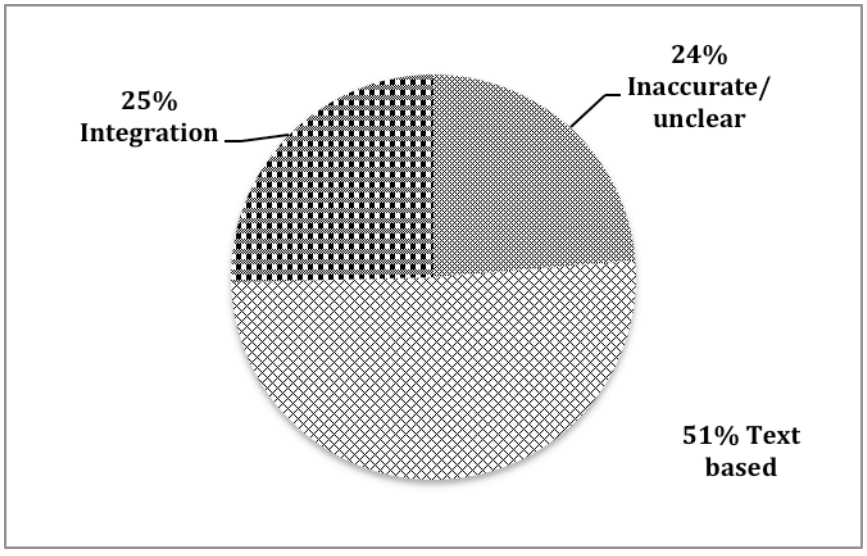
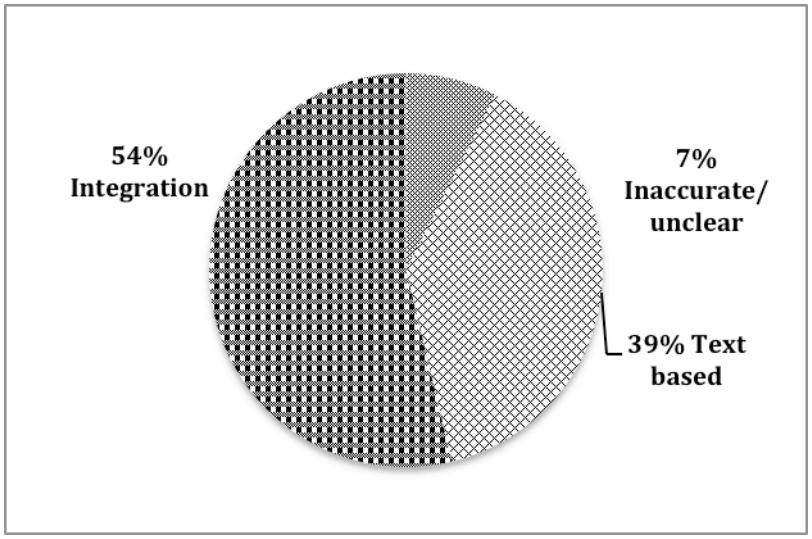


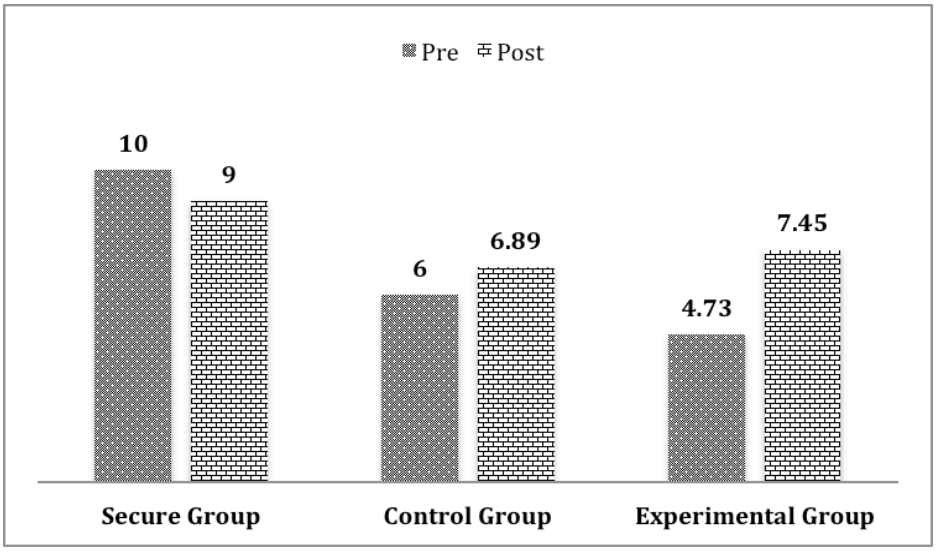
Figure 5: *Experimental Group- Post project Verbal Protocol Averages for Raptor text*



Students in the experimental group shifted the way they interacted with the text, and this type of shift was not seen among the control group.

Retell averages increased. The students in the experimental group increased in the amount of text they remembered reading during their retelling of the raptor text.

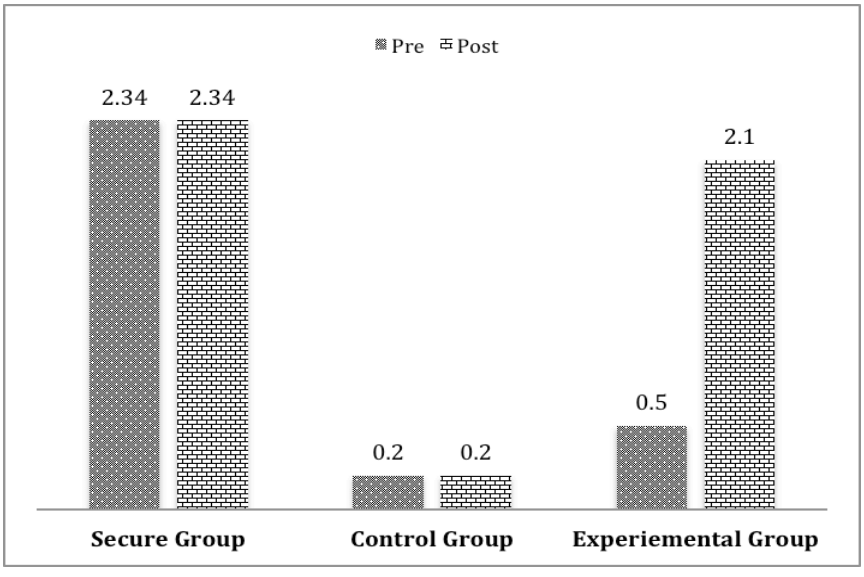
Figure 6: *Retell Averages for the Raptor Text*



The experimental group grew an average of 37% between pre- and post-assessments, while the control group grew an average of 13%. I believe the experimental group grew more for two main reasons. First, students in the experimental group were more familiar with the content they read, so it was easier for them to form a mental representation of this text in their memory. Second, students tended to retell portions of the text that they had spoken about during verbal protocols. Since students in the experimental group spoke more during their verbal protocols of this raptor text, it makes sense that they remembered more of what they had just talked about. The change in retell points reflects the change in number of statements made during verbal protocols with this text.

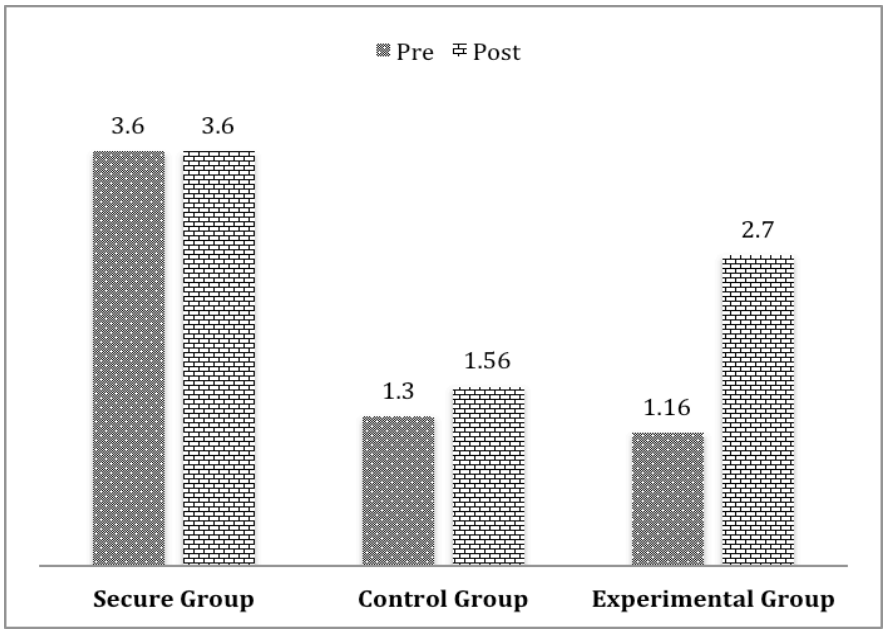
Scores in literal and inferential thinking increased. The scores of the experimental group displayed growth in both literal and inferential thinking. See Tables 7 and 8 below.

Figure 7*: Pre- and Post-Assessment Scores on Hawk Text for Literal Response*



These scores point to the possibility that content grouped texts, along with focused coaching while students read, improved students' ability to answer literal questions. Students in the experimental group increased points for the literal question: What is a raptor? Give at least 3 characteristics. It is unclear whether students increased their points for this question based on their ability to pay closer attention to the text or because they grew in their prior knowledge from reading about raptors over the past month.

Figure 8: *Pre- and Post-Assessment Scores on Hawk Tex for Inferential Response*



Students in the experimental group also increased points for the inferential questions: Why is a healthy hawk population important for humans? What can humans do that would be helpful to hawks? Some students in the experimental group answered the inferential question correctly, but it was based on information students had read on other days rather than the current content in the hawk text. Students who answered the question correctly but did not show a strong connection to the text itself received half

credit for their score on the inferential questions. Other students made an inference that integrated the text content within the text or between the text and prior knowledge. Students who answered the question correctly and did show a strong connection to the text received full credit. Growth in the students' ability to integrate information indicated that these students made progress in the area of comprehension. Based on the increase in student's scores for the hawk text, it is reasonable to assume that reading from content-grouped texts and receiving focused coaching in their thinking over the past month impacted students' comprehension in a positive way.

Conclusion

The developing readers in this study all had similar profiles coming into this study based on a comparable range of scores on standardized assessments, but my findings suggest developing students' struggles with comprehension are unique. Reading specialists listened to children think out loud as they read, and this helped them identify where and why students were struggling. During reading is a much better point in time to be able to coach students with their comprehension than at the end of reading. In addition, the reading specialists and I found that content matters for reading comprehension. By grouping texts by content, students had more opportunities to integrate information, and content familiarity influenced reading comprehension.

Chapter 5: Implications and Discussion

Reading interventions often focus on developing reading skills without taking into account the influence of content knowledge for reading. For this study I grouped texts by content area to examine the influence of content familiarity on learning for students in an intervention setting. I found that content familiarity is an important variable for comprehension, evident in students' cognitive processes while reading texts, valuable for comprehension development, and impacting the comprehension product. In addition, comprehension is often assessed as a product of reading, and this makes it difficult to know why and where reading comprehension breaks down for individual students. My intervention used verbal protocols as a formative assessment tool to study ways a group of reading specialists used information from verbal protocols for their instruction. I found that the information from verbal protocols was used effectively by reading specialists to coach students with their processing of texts. Our study drew on the Landscape Model (van den Broek et al., 2005) to help us identify students' needs related to comprehension processing of texts.

Findings and Implications for Data Collected Pre-instruction

I examined ways secure and developing readers differed in their comprehension while reading an informational text. Before our instruction began, I collected data on students' background knowledge of raptors, written responses to a hawk text, verbal protocols for a raptor text, and retell of the raptor text. From these data I found that secure and developing readers differed in their decoding and retell of text, the number of words they spoke in think-aloud statements, the number of integration statements they

made, and their literal and inferential written responses to the hawk text. In the next section I discuss the implications of these findings.

Literal and Inferential Written Responses to the Hawk Text

Secure and developing readers differed in their answers to literal and inferential questions with the hawk text. Secure readers were able to answer literal and inferential questions accurately, but most developing readers either left the answer space blank or had difficulty answering these questions accurately. I did not give students access to the text while they wrote their responses to the text.

There is growing evidence that text comprehension is linked to working memory (Kendou et al., 2014). In three experiments that studied individual differences in working memory for reading comprehension of expository texts, students with a low working-memory span had a difficult time retaining information from the text when they didn't know what the topic of the text was (Budd et al., 1995). Thematic processing supported all of the readers' retention of information in the expository texts.

There are a number of ways educators can support thematic processing of texts for students in schools. One of these ways is to group texts by content area or by a big idea and provide instruction that helps readers think about these big ideas. Also, teachers can support students with comprehension by providing graphic organizers that coordinate and manage information around the big ideas. In our study, students used semantic mapping to organize the information they were thinking about raptors, and teachers coached students to connect what they were thinking with the big ideas in the text as they read. Further, if the goal of a particular reading situation is to learn information from a

text, lower span readers may benefit from being explicitly told the big idea in advance of reading the text.

Differences in Decoding and Retell Data

Another important finding from my pre-instruction assessment data was that developing readers differed in their challenges with reading. The four **most accurate** developing readers decoded the raptor text with the same level of accuracy as the secure readers but were not able to retell as much information about the text. By contrast, the four **least accurate** developing readers read the raptor text at a lower level of accuracy but were able to retell almost the same number of ideas from the text as the secure readers. These were resilient readers. Their effortful decoding did not get in the way of their comprehension of the text. Among developing readers, the slowed and effortful reading led to stronger comprehension than the automatic processing of texts. These findings indicate that automaticity in decoding and fluency does not necessarily translate to increased comprehension.

Some researchers believe that increased fluency will lead to increased comprehension (Hudson, Lane, Pullen, 2005). This belief can be attributed to views of automaticity that encourage readers to decode effortlessly to ensure that there is adequate processing capacity for comprehension (LaBerge & Samuels, 1974). However, researchers have also found that effortful decoding can lead readers to increase their comprehension scores, whereas fluent reading sometimes allows students to let their minds wander (Walczyk & Griffith-Ross, 2007). In my study, automaticity did not ensure comprehension, and effortful decoding often produced good comprehension.

The distinctions between decoding accuracy and comprehension in my study suggest that reading programs intended to increase automatic processing need to be used with care. Developing readers who read automatically and accurately may benefit from slowing down their reading to think more about the text. In addition, developing readers who decode with effort may utilize context successfully to help them decode. Though decoding accuracy and fluency for readers is an important goal, it is critical to provide opportunities for students to utilize meaning as a strategy for decoding.

Product scores in reading comprehension assessments do not differentiate well between comprehension and decoding (Keenan, Betjemann & Olson, 2008), and comprehension assessments differ in the skills they are predominantly assessing (Kendeou, Papdopoulos & Spanoudis, 2012). Still, school leaders purchase programs designed to develop a narrow skill for reading and sometimes place all developing readers in these programs (Allington, 2013). When students in schools receive a low score on a reading comprehension test, it is important that educators gather more information to differentiate between decoding, fluency, and comprehension. Further, it is worth considering whether decoding and fluency programs that support increased automaticity with reading texts lead some students to overlook comprehension.

Differences in Verbal Protocol Statements

By looking closely at verbal protocol statements made by secure and developing readers compared to pre-established categories of Constructively Responsive Reading (Pressley & Afflerbach, 1995), I identified patterns in statements that differed between secure and developing readers. Secure reader statements were generally longer than

developing reader statements and involved an integration of information across the text or between background knowledge and the text. By contrast, developing reader statements were generally shorter and focused on a text-based level of understanding of the text.

This difference is important when considering research on readers' retention of information from texts. When readers integrate information with texts, this level of representation of the text lasts longer in memory than when readers represent texts with only a surface level or text-based level representation (Kintsch et al., 1990). The process of integrating background knowledge with the text is described in models of cognitive processes of comprehension (van den Broek et al., 2005). When information is activated during reading, this activation spreads across a network and links to related concepts, but when information is not well connected with prior knowledge or well connected in the text, it drops out of activation (van den Broek et al., 2005). As secure readers in my study integrated information with the text, they strengthened their conceptual understanding about raptors, and this conceptual understanding was available longer in their memory. Conceptual knowledge is a powerful influence in comprehension of informational texts (Duke et al., 2011). By contrast, when the developing readers paraphrased the text and developed a text-based level of representation, their memory of information in the text likely faded quickly.

Another difference between the secure and developing readers' verbal protocol statements was the finding that developing readers made errors in processing that led to incorrect statements about the text. These errors included overgeneralizing what the text said, not understanding how the different pieces of the text fit together, and ignoring what

the text said to fulfill a personal goal from the text. Each of these processing errors led students to an inaccurate interpretation of the text.

Researchers study these processing errors in lab settings (Rapp et al., 2007), but they are not often identified in the context of reading instruction in schools. Without understanding the errors students make while processing texts, it is difficult to provide focused instruction for developing readers. The reading specialists and I were not aware of the processing errors from previous assessments until we listened to students think out loud about the text. The knowledge reading specialists gained from the verbal protocol assessment was valuable for knowing how to scaffold instruction for their students.

Content Knowledge Influenced Comprehension Processes

More than half of the students in the developing group of readers drew on content from the hawk text while reading and retelling the raptor text. The content overlap between these texts activated both memory-based processes and coherence-based retrieval processes (van den Broek et al., 2005). The memory-based process that passively linked content from one text to the next often led developing readers to an inaccurate statement about the text. On the other hand, the conscious, strategic process of coherence-based retrieval often led developing readers to an accurate statement about the text. Kendou and van den Broek (2007) found that memory-based processes sometimes activate information from a reader's memory that is not relevant to the text. In lab studies, secure readers engage in strategic processes to fix inaccuracies and achieve coherence whereas developing readers often do not recognize these inconsistencies or breakdowns in comprehension (Kendou & van den Broek, 2007). This difficulty

recognizing inaccuracies was evident among the developing readers in my study. An important question to consider is why developing readers do not recognize inconsistencies between the text and their interpretation of the text. There are many factors to consider: standards of coherence (van den Broek et al., 2011), metacognitive skills (Palinscar & Brown, 1984), the interaction of background knowledge with texts (Brozo, 2010), and executive skills such as working memory and attention allocation (Swanson & Berninger, 1995). In my study these inconsistencies improved between pre- and post-scores, but they were still part of the errors students made. The ability to recognize inconsistencies between the text and a reader's interpretation of the text is best addressed while students are reading the text, as inconsistencies that are not attended to while processing text influence the product of comprehension (Kendou et al., 2014).

Comprehension assessments commonly used in schools do not look at cognitive processes of comprehension, and there is generally a lack of meaning-based assessments (Lesaux & Marietta, 2012). Rather than providing instruction to students based on an understanding of individual students' comprehension processing needs, teachers may be left with curriculum alone to structure lessons. This lack of formative knowledge about individual students' comprehension processes can result in whole group lessons that provide a surface level introduction to comprehension strategies and skills that are used in isolation. The data from our pre-instruction verbal protocol assessment demonstrates the need for process assessments to be developed that can help practitioners develop a better understanding of comprehension processing for their class of students.

Findings and Implications for Data Collected During Instruction

During the implementation phase of the intervention I examined the ways a group of reading specialists used information from verbal protocols for their instruction. I collected field notes, emails, audio recordings, and reading specialist summary notes for data. My findings from these data demonstrated that reading specialists used information from verbal protocols to better understand how individual readers processed text, and to coach students with comprehension processes based on identified needs. I also examined the way reading instruction that scaffolds instruction by taking into account content familiarity, text difficulty, and reading for authentic purposes interact with learning. My data affirm the value of taking into account content familiarity, text difficulty, and reading for authentic purposes. Because I collected only a limited amount of data on text difficulty and reading for authentic purposes, I discuss these findings in the limitations portion of this chapter. In the next section I discuss the implications for my findings on verbal protocols as a formative assessment tool and content familiarity as an interaction with learning.

Verbal Protocols as a Formative Assessment Tool

Comprehension is often measured in schools as a product or outcome, and this makes it difficult for practitioners to understand where and why comprehension breaks down for individual readers (Duke & Carlisle, 2011; Pearson &Johnson, 1978). In my study, reading specialists and I discovered that verbal protocols, used as a formative assessment tool, helped educators to examine students' comprehension processes while reading texts.

Verbal protocols were easy to implement for both teachers and students. Reading specialists sat next to individual students as they read independently and prompted them to think out loud. The reading specialists in my study discovered valuable information they had not known about where and why reading broke down for individual readers. I believe verbal protocols can be used in schools as a formative assessment tool for practitioners and will provide valuable information about individual readers' comprehension processes. This information can then potentially lead to individualized instruction.

Verbal protocols do not only provide information about errors students make as they process texts; they also illuminate students' successes. In recognizing the processes that are working well, reading specialists have the opportunity to make these processes explicit for students. By making these processes explicit, students can internalize the processes and use them outside of the intervention setting. This increased metacognition is valuable for learning (Palinscar & Brown, 1984). Also, it is important that students who are struggling with reading are told about what they are doing well so that they don't attribute their challenges with comprehension to a permanent deficit (Dudley-Marling, 2011).

Theory in the Context of Practice

The reading specialists and I referred to the Landscape Model (van den Broek, 2005) to understand what the verbal protocol statements revealed about individual students' processing of text. In putting this model of reading to work in a school setting, we found that the Landscape Model provided valuable information for reading specialists

about how readers process texts. This knowledge guided practitioners to recognize the processes students used based on verbal protocol statements and led educators to coach students in their thinking. The Landscape Model transfers well from a lab to a school setting. Specifically, based on the Landscape Model, reading specialists identified challenges with reading comprehension as belonging to difficulty with text input in the current sentence; carryover from a previous sentence (or lack of carryover); the current representation of the text in memory or difficulty grasping the big idea of what the text was all about; or prior knowledge that led students away from the text or wasn't being used at all. I developed prompts for reading specialists to use based on the Landscape Model, and reading specialists used these prompts to coach students to draw on the sources of information explicated through the Landscape Model.

This coaching process is similar to the coaching a teacher might do with a reader's decoding based on a running record. The reader leads the reading, and the reading specialist observes and guides students to find more clarity and connections with the text. Reading specialists are not trying to solve a problem for the students, they are empowering students to engage in processes that can be internalized and applied to all of reading. My research indicates that comprehension instruction for developing readers can be individualized to the needs of the student. In my experience, reading specialists in schools welcomed the opportunity to better understand and individualize instruction related to the comprehension development of their students.

Mystery Texts

Mystery texts were a valuable tool for supporting comprehension development for many reasons. They allowed reading specialists to examine students' processes with a text in a short amount of time. They also allowed reading specialists to see what content from the texts students were drawing on in their comprehension processes. In addition, mystery texts supported students in making inferences. Inference making is a source of difficulty for developing readers (Kendou et al., 2014), and was an identified challenge for the developing readers in our study. By explicitly coaching students to fill in gaps in text cohesion, students drew on prior knowledge and integrated information with the text.

An additional strength of mystery texts was that it gave readers the explicit message that thinking changes across a text as you read (Pearson & Cervetti, 2015). Many developing readers in our study wanted to stick with the first idea that came into their heads, and then they ignored clues in the text that were not consistent with that first idea. Also, students often read generally, thinking they knew what the text was about. Readers can resist changing their thinking if the information in a text does not match their beliefs (Kendeou et al, 2011). Mystery texts surprised students and disrupted generalized reading. Students learned to pay careful attention to the text and change their thinking based on the new information they read.

Researchers have found that a lot of comprehension 'instruction' in schools is really a comprehension assessment as teachers check to see if students 'understand' a text (Dolores Durkin, 1978; Pressley et al., 1998). Comprehension instruction in schools can lead readers to believe there is one answer to a question, and see that answer as static.

When educators approach reading as a process, they disrupt this static representation of reading. In actuality, people read to grow, learn, experience, and adjust thinking based on new information found in texts. Reading comprehension is a dynamic transaction between the reader and a text (van den Broek et al., 2005; Rosenblatt, 1978). This process is more cyclical than linear. It is important that reading comprehension instruction in schools refrains from quick right or wrong responses to questions about text, but rather provides room for students to stretch and consider how new information changes their thinking across a text.

Content Familiarity

Content familiarity is an important variable for comprehension, evident in students' cognitive processes while reading texts, valuable for comprehension instruction, and impacting the comprehension product. In the pre-instruction assessments, content overlap among texts influenced the way students either strategically integrated information across the texts or unintentionally drew on linked concepts in memory. During instruction reading specialists saw a benefit to grouping texts by content area. Students in our study were motivated by the consistency in texts and realized they were carrying over information from one text that led them to feel confident about a new text. Motivation from grouping texts by content area has been shown to improve comprehension (Guthrie et al., 1996). Also, content-grouped texts allow teachers to coach students with the integration process. Content knowledge is valuable for developing readers because knowledge activates automatically as students read and doesn't take processing effort (van den Broek et al., 2005).

Reading curriculum and instruction can engage students in building content and conceptual knowledge during their reading. An important question for practitioners to consider is whether the goal of the lesson is to gain mastery of skills in isolation or to use strategies as needed to support learning from texts. Data from my study indicate that there is value for content and learning to drive instruction, and for comprehension strategies and skills to be modeled and coached as needed when reading gets tough.

Findings and Implications for Data Collected Post-Instruction

My fourth research question examined whether reading instruction that scaffolds instruction by taking into account content familiarity, reading for authentic purposes, and verbal protocols improves learning. My primary sources of data for this question were pre- and post-instruction scores on students' written responses to texts, verbal protocols, and retellings. My secondary sources of data were field notes, emails, audio recordings, and reading specialist summary notes. From my data I discovered that students in the experimental group grew in ways that were not seen from the students in the control group. I describe the implications for this growth in the following section.

Growth in Decoding Accuracy

Some of the growth we saw from readers was not directly connected to instruction. For example, developing readers grew more than the control group in decoding accuracy and ended the study with a post-instruction decoding average similar to the secure readers. Other than periodically coaching students to break long words into chunks as they read, the reading specialists and I did not work on decoding as part of our reading instruction. Perfetti and Stafura (2013) studied the link between word

identification and comprehension and demonstrated that word identification is tied to word knowledge and the way readers integrate words with content in the text. A possible reason that students increased in decoding accuracy without instruction is the influence of content familiarity on decoding. Decoding is a meaning-making process, and the students in our study were more familiar with the content they read than the control group. Students in the experimental group were able to draw on their conceptual understanding of the text to help them decode.

Another reason decoding accuracy may have increased without focusing directly on students' decoding skills is that we coached students to read carefully. By listening to students read and think about the text, we identified errors in processing such as skipping lines of text, skipping words, reading quickly, and over generalizing. As we coached students in their thinking, they became more careful in their processing of texts, and I saw that this coaching supported students' increased accuracy in decoding. Upper elementary students often read silently in schools. Our findings suggest that it is important for teachers to periodically listen to developing readers read out loud to better understand their processing of texts and know how to coach students as they read.

In addition, decoding accuracy may be related to the increased time students spent reading. In the district purchased intervention curriculum, students read one text per week, sometimes only a few pages a day; in contrast, the students in our study read an average of three texts per week. Time spent reading has been attributed to reading growth in research studies (Taylor, Frye & Maruyama, 1990). Our data support instructional

approaches that balance the teaching of decoding strategies with time spent reading meaningful texts.

Growth in the Number of Words Spoken

Developing readers in the experimental group increased the number of words spoken during verbal protocols between pre- and post-assessments. One of the reasons I believe students in the experimental group grew so much in the amount they talked about the text is that they grew in their knowledge about raptors. As students read about raptors in the post-instruction verbal protocols, their knowledge about raptors was activated. The Landscape Model (van den Broek, et al., 2005) describes the cognitive process of comprehension as a co-activation of information from memory that, along with the words on the page, spreads and links to form conceptual understanding. Increased knowledge about raptors provided opportunities for the activation of information that was linked to knowledge in memory.

In addition, students in the experimental group were comfortable with the process of thinking out loud because they engaged in this process throughout my study. If readers shared more of their thinking about the text because they were comfortable with this process, then it is possible to consider verbal protocols as a useful instructional approach that raises cognitive engagement and metacognition while reading. The increase in the number of words spoken among the experimental group was a strong finding, and this finding was consistent in all but one of the students in the experimental group.

Growth in Retell Data

The increase in the number of words spoken during verbal protocols paralleled the increase in students' ability to retell the text. The act of thinking out loud about texts seemed to increase students' retention of the content they read. Verbal protocols are frequently viewed as a method of inquiry and a way to model how strong readers process text (Kucan & Beck, 1997). In my study, the reading specialists and I expanded the use of verbal protocols to include a formative assessment tool for comprehension and an instructional tool that supported learning. Pausing to think out loud moves students out of an automatic processing mode and increases the amount of time readers spend considering the meaning of the text (Walcyk et al., 2007). A few of the students told me that talking out loud about the text helped them remember what they read. The following statement was made by one of the developing readers in the experimental group and audio recorded by one of the reading specialists on our last day of the project.

> "When I was thinking in my head, I wasn't getting much done because I would always forget… and I was getting stuck on problems. And then now when I'm saying them out loud I know what I'm thinking. Everything I think out loud I remember at the end."

This student was aware of the correlation between thinking out loud about the text and his increased memory of information from the text.

In another example, retell data showed a correlation between the words a student spoke during verbal protocols and what the student said about the text in the retell assessment. For example, Micah read the words in the raptor text: *Imagine you're a small animal, scurrying low to the ground, going about your day*. Then he thought out loud during the verbal protocol assessment, *"I would want to be a hedgehog because they're*

awesome." Later during his retell of this text he said, *"So it told you, it, it like told you, imagine you are like a rodent, so yeah, pick a rodent, and I picked a hedgehog because those things are freaking awesome."* In this example, Micah is retelling the text based on what he remembered saying about the text, adding his own thinking during verbal protocols to his retelling of the text. During conversations, the reading specialists and I discussed the way students seemed to remember the information they spoke about during verbal protocols. We concurred that verbal protocols were not only valuable for formative assessment, but also supported students' comprehension development and retention of information from texts.

In addition, topic-relevant knowledge has been shown to trigger processing strategies and increase students' recall of information from a text (Wolfe, 2005). In Wolfe's study the ability to consider semantic associations predicted expository recall of texts, and a reader's prior knowledge of the topic influenced the reader's semantic associations. In my study students may have increased their recall of the ideas in the text because they were able to organize information by topic and consider the semantic relationship of the ideas.

Growth in the Integration of Information During Verbal Protocols

The students in the experimental group grew in the number of statements that integrated information with the text between pre- and post-instruction assessments, and this growth was not seen in the control group. As discussed earlier, secure reader statements during the verbal protocol assessments integrated a lot of information. 86% of the statements made by students in the secure group during the pre-instruction assessment

integrated information with the text. By contrast, 25% of the statements, made by students in the experimental group during pre-instruction assessments, integrated information with the text. During post-instruction assessments, the students in the experimental group increased the percentage of statements that integrated information to 54%. The average number of statements that integrated information in the pre-instruction assessments per student in the experimental group was 2.63 statements, and the average number of statements that integrated information during post-instruction assessments was 7.81. This growth in integration information is important when considering learning and retention of memory from texts. As discussed earlier, integration of information with a text is an important process of comprehension (van den Broek et al., 2015) and this integration results in a situation model of reading that lasts longer in memory than the text-based representation of reading (Kintsch et al., 1990).

Less skilled readers have difficulty integrating information with texts, and these difficulties can be classified as paraphrasers, who fail to integrate information with the text, and elaborators who move thinking too far outside of the text (McMaster et al., 2012). These groups of students respond differently to different types of instruction. Causal questioning benefits paraphrasers, whereas the general question, "How does the sentence you just read connect with something that happened before in the story?" benefits elaborators (p. 105, McMaster et al., 2012). It is important for teachers to understand the challenges readers face while processing texts in order to provide effective instruction. Reading specialists in my study were able to identify both of these challenges through the use of verbal protocols, and in recognizing these types of errors reading

specialists coached students to either integrate thinking by connecting text to prior knowledge, or coached students to bring a connection back to the text when readers elaborated too far outside of the text.

Data from our study indicate that the integration of information from texts can be influenced by instruction. Students in the experimental group read texts about raptors, and this increased knowledge about raptors that was activated while reading the post-instruction assessment text about raptors. In addition, reading specialists coached students in the integration processes while reading the text. This coaching supported the process of integrating information with texts and helped build conceptual understanding about raptors from the text. Reading specialists made the integration process explicit to students as they coached students' reading in the hopes that students would integrate information in other settings, and it appears this coaching was successful. Yuill and Oakhill (1988) also studied the influence of instruction on children's inference making, and found that children in the intervention-training group made more progress than children in the decoding-training group.

The integration of information within and across texts is an important goal for comprehension (Kole & Healy, 2007; Pearson & Cervetti, 2015), and educators can identify this challenge and provide instruction for students at young ages (Kendeou et al., 2008). Kendou and colleagues studied the inference making of young children across different media across time and determined that children's inference making at the ages of 4 and 6 was highly correlated to their comprehension at the ages of 6 and 8. Early support with the integration of information may help young students build cohorts of

knowledge that can be accessed at later ages as children read. Though our study focused intervention on fourth and fifth grade readers, early identification and instruction of inference making is possible.

Growth in Literal and Inferential Responses to the Hawk Text

Students in the experimental group increased their scores for literal and inferential responses to the hawk text between pre- and post-instruction assessments, and this growth was not evident in the control group. Increased knowledge about raptors likely impacted students' ability to answer the questions on the hawk text. Prior knowledge has been strongly linked to comprehension processes and comprehension products (Kole & Healy, 2007; Gelzheiser et al., 2014; Kendou & van den Broek, 2007). In the general education classroom, content area reading is thought to help prevent failure and avoid the need for students to be placed in interventions (Brozo, 2010). This is based on the idea that high quality instruction includes content area reading (CCSS: www.corestandards.org). Students who primarily read simple texts and are not exposed to informational texts in the regular education classroom may not develop the domain knowledge and understanding of informational text structures needed for comprehension. My research adds to this by suggesting that content area literacy also belongs in reading interventions. Content knowledge is inseparable from comprehension. It influences the comprehension process, comprehension development, and the comprehension product. By including content grouped texts in the intervention setting, developing readers have the opportunity to lay a foundation of information on which to attach new information. In addition, developing readers' motivation may increase as they gain a sense of expertise

about a topic. Further, by providing content-grouped texts in the intervention setting reading specialists have the opportunity to coach students with the integration of information.

Another benefit of grouping texts by content area is that students are focused on reading to learn rather than reading to improve a test score. One of the students in my study did not realize that I was a reading teacher. He thought that I was a raptor teacher coming to the school to teach the students about raptors. Because my intervention focused on reading to learn about raptors, students were less likely to self-identify as struggling readers. When readers self-identifies as struggling, they can lose agency and motivation to read (Vlach & Burcie, 2010). By developing expertise about raptors and sharing this expertise in a book students created, students operated out of a sense of accomplishment rather than a sense of deficit.

Limitations

There are a few limitations to this study that are worth mentioning. Specifically, I did not collect much data related to project-based learning or text-difficulty. In addition, my participant size for this project was small.

Project-Based Learning

I anticipated motivation and engagement to be a challenge for the developing readers in my study, but pre-instruction assessment data revealed that the students in my study were motivated and interested in reading and learning about raptors. Based on these pre-instruction data, I collected very little data about the project-based nature of this intervention. I do know that many of the students were motivated by the project, and

these students periodically asked me about the book they were going to make for the raptor center. One student told me that the book at the end was her favorite part of reading about raptors. The connection between what students read and the book they were making, along with the opportunity to visit the raptor center, did motivate students. However, this finding was limited to our observations.

Text Difficulty

Lab studies have shown that text cohesion influences reading comprehension (McNamara & Kintsch, 1996). I wanted to select texts for my intervention that gradually increased in difficulty to support learning. I found this difficult to implement through the tool Coh-metrix (Graesser et al., 2011). Coh-metrix identifies five dimensions of text difficulty related to comprehension, and the texts that I found about raptors varied in unique ways for each of the dimension of difficulty. For example, some texts were considered difficult according to referential cohesion but were syntactically simple and used concrete language. Other texts were syntactically complex, lacked global cohesion, but were easy when considering referential cohesion. In the end, the texts I selected gradually increased in difficulty based on the grade level rating from Coh-metrix rather than the five dimensions of text difficulty. Hiebert (2013) also found that texts are not uniformly simple or complex across different dimensions of difficulty, and teachers need to make wise decisions about how these dimensions influence different students in different ways.

The reading specialists and I did find Coh-metrix useful as a way to consider different dimensions of text difficulty related to our observations of students' challenges

with texts. We found that students responded differently to different dimensions of text difficulty. Our data for this finding were limited to our observations. Though text difficulty ratings can provide a useful perspective, ultimately we found that listening to a reader think out loud as they process texts provides a better lens on how different types of text difficulty influence different readers.

Participant Size

My participant size was small for testing an intervention, and this limits my ability to generalize or contribute to more than local theory. I would consider this a pilot study. There is a lot of potential to expand on the work that the reading specialists and I began.

Future Research and Iterations

Design-based research provides opportunities for an intervention to evolve over time and be iteratively tested in multiple contexts (McKenney & Reeves, 2012). I would like to continue testing aspects of my intervention in new contexts. These iterations can be thought of as sub-studies that fit within one complete study.

Iteration: More research is needed to support the integration of information from texts for developing readers. Van den Broek et al. claim, "Any kind of inference, can in principle be generated by virtue of either memory-based or memory-based –followed-by-constructionist processes, given the right combination of text and reader variables." (P 311, van den Broek et al., 2005). Future research is needed to explore the right combination of text and reader variables that support integration of information. In

addition, I would also like to study the influence of modeling the integration process with informational texts.

Iteration: In addition, more work is needed to develop verbal protocols as a formative assessment tool. There are many questions I would like to explore including: What length of passage provides reading specialists useful information about the comprehension process for individual readers? How does text difficulty influence the value of the information from verbal protocols? Would classroom teachers benefit from using verbal protocols as a formative assessment tool? What level of expertise about reading comprehension processes is needed to use verbal protocols effectively as a formative assessment tool? How can verbal protocol data be easily recorded for further analysis? Research in these areas is needed to develop verbal protocols as a formative assessment tool.

Iteration: Further, the reading specialists and I coached students as they read texts based on our understanding of processes described in the Landscape Model (van den Broek et al., 2005) and think-aloud data. More work is needed to study and refine these prompts and the coaching process so that they are most effective for students' learning.

Iteration: Also, to really understand the value of content grouped texts for learning in an intervention setting, and to understand the value of coaching students based on verbal protocols, my intervention needs to be tested with more students in more contexts. Hoadley (2004) suggested that iterations of a design could explore generalizability and discover how the local and global interact. Also, by replicating the

intervention in multiple contexts, I would have more opportunities to understand contextual variability.

Iteration: Finally, my study confirmed the value of reading content-grouped texts for reading comprehension. I tested the influence of reading content grouped texts about raptors by giving students texts about raptors for their post-instruction assessments. I would like to know whether the improvements we saw with the raptor text would transfer to a text that is not about raptors. In other words, do developing readers benefit from reading content-grouped texts only within that content area, or does the opportunity to integrate information with texts and build conceptual understanding through texts transfer to increased reading comprehension in a new content area? Also, further work is needed to explore ways the number of texts grouped by content area and the length of time spent reading within one content area influence learning.

Design Principles

The outcomes for design-based research can be described as theoretical understandings of a prescriptive nature (McKenney & Reeves, 2012). The design principles for my intervention are humble, local, and prescriptive. They can be used to support the work of scaffolding learning from informational texts for developing readers in an intervention setting.

To develop a formative approach to assessment and instruction for students who struggle with comprehension, teachers can:

-Become familiar with processes of comprehension described in models of cognitive processing

-Listen to students think out loud as they read text using the prompt, "What are you thinking?"

-Coach students with their processing of texts based on an understanding of how individual students are processing the text

To design comprehension intervention instruction:

-Design comprehension instruction based on the identified needs of individual students' comprehension processes

-Create lessons that take into account the influence of content familiarity for comprehension and learning

-Support the integration process and the development of conceptual understanding from reading

-Group texts by content area so that developing readers view reading as an opportunity to learn and grow

-Help readers manage and organize information from reading around big ideas and themes

Final Remarks

I designed my intervention to test the influence of scaffolding on learning by taking into account content familiarity, text difficulty, and reading for authentic purposes while learning from informational texts. I also sought to discover how reading specialists might use information from verbal protocols for their instruction. On a local scale my reading intervention impacted comprehension instruction for the reading specialists and students in the intervention setting. The reading specialists increased their understanding

of individual students' comprehension processes through verbal protocols and coached students based on identified needs. These reading specialists now use verbal protocols and coaching prompts with students outside of my study. In addition, reading specialists increased the number of content-grouped texts in their intervention curriculum. I believe our collaborative work will spread in the district as reading specialists share what they learned with classroom teachers and literacy leaders. On a broader scale, I would like our collaborative work to influence the education community by raising awareness of the importance of content familiarity for comprehension processes, comprehension development, and the comprehension product. In addition, I would like verbal protocols to be developed as a formative assessment tool because I observe that educators in schools need better information about students' processing of texts to support reading comprehension development. These are valuable goals. Reading without understanding widens the achievement gap, and the ability to learn new information from texts influences academic success from elementary school into the workplace (Duke & Carlisle, 2011). The act of creating meaning with texts is complex, but our understanding of cognitive processes, and not just comprehension outcomes, provides valuable information for supporting students in learning from texts.

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Appendix A: Raptor Text used for Verbal Protocols and Retell
A portion of: raptor! A kid's guide to birds of prey (Laubach & Smith, 2002)
(Numbered for retell assessment)

1- Imagine you are a small animal, 2- scurrying low to the ground, going about your day. 3- Suddenly you sense that something is watching you. 4- You look around, but you don't see anything. 5- Scary, isn't it?

6- Now imagine that whatever is hunting you has amazing powers. 7- If you hide in the dark, it will find you. 8- It's hearing is so good that it can hear your heart beating. 9- Its' eyes are so sharp that even when you can't see it, it can still see you. 10- If you run, it will swoop out of the air and seize you with sharp talons. 11- Once it has captured you, it will use its sharp hooked bill to eat you.

12- You could be many different animals, such as a mouse, a bird, a cat, or a duck. 13- But the incredible predator that hunts you can be only one thing: a raptor.

14- No matter where you live in North America, raptors are living nearby. 15- Peregrine Falcons nest on skyscraper ledges in our cities. 16- Bald Eagles live along our rivers and seacoasts. 17- Hawks soar above farms and highways. 18-As night falls, the owls awaken in city, suburbs, and countryside.

19-Raptors have evolved over millions of years to be the most efficient winged predators in the world. 20- They have to be stronger and faster and have sharper senses than their prey to survive. 21- The result is a group of birds with abilities that are truly astonishing.

22- Raptors are not just fierce. They are independent, intelligent, and loyal to their families. 23- They are important parts of a healthy ecosystem. 24- Without raptors, the rodents would not have enough food. 25- There would be a massive die-off, and disease would spread. 26- Like all predators, raptors are necessary to keep the natural world in balance.

Appendix B: Pre-Post Data-Verbal Protocol, Decoding, Retell

Name	Decoding January	**Decoding March**	Retell-January	**Retell- March**	Number of words in VP January	**Number of words in**	Number of statements	**Number of Statements**	Inaccurate/Unclear VP January	**Inaccurate/Unclear VP March**	Text Based VP-Jan	**Text Based VP-Mar**	Integrating VP -Jan	**Integrating VP-**
Ro	99	**99**	9	**9**	596	**324**	33	**24**	0	**0**	4	**7**	27	**17**
Do	100	**99**	8	**9**	250	**185**	15	**11**	0	**0**	3	**2**	12	**9**
Jo	99	**100**	14	**12**	187	**331**	10	**15**	0	**0**	1	**2**	9	**13**
Li	97	**99**	8	**8**	148	**87**	9	**6**	3	**-**	1	**4**	4	**2**
Ria	97	**98**	10	**7**	87	**48**	6	**5**	-	**-**	3		3	**5**
Os	100	**100**	3	**3**	54	**71**	4	**7**	-	**1**	3	**4**	1	**2**
Mar	91	**93**	7	**6**	35	**67**	6	**8**	-	**-**	5	**5**	1	**3**
Car	93	**93**	9	**8**	96	**70**	8	**8**	1	**-**	2	**7**	5	**1**
Cel	92	**95**	8	**10**	127	**97**	9	**8**	-	**-**	7	**7**	2	**1**
Ame	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**	-	**-**
Ta	92	**95**	3	**4**	298	**79**	9	**7**	5	**3**	2	**3**	2	**1**
Ril	99	**98**	4	**11**	118	**202**	6	**10**	1	**-**	4	**4**	1	**6**
Mat	97	**98**	2	**5**	116	**115**	5	**7**	4	**-**	1	**4**	-	**3**
Co:Ma	99	**100**	5	**8**	259	**310**	24	**25**	9	**2**	9	**15**	6	**8**
Co:Ga	98	**99**	10	**10**	211	**389**	16	**21**	1	**-**	6	**9**	8	**12**
Co:Mil	100	**100**	4	**7**	109	**167**	4	**10**	-	**-**	2	**2**	2	**8**
Co:Bo	94	**99**	6	**8**	263	**216**	9	**9**	6	**1**	1	**3**	2	**5**
Hi:Ja	95	**99**	4	**4**	65	**303**	6	**14**	-	**-**	6	**4**	-	**10**
Hi:Ch	97	**99**	3	**8**	103	**224**	6	**10**	1	**4**	3	**3**	2	**4**
Hi:Kh	98	**99**	6	**8**	94	**247**	10	**12**	2	**3**	7	**6**	1	**3**
CV:De	92	**97**	5	**13**	111	**280**	14	**22**	1	**1**	12	**7**	2	**14**
CV:Mi	97	**99**	2	**8**	95	**155**	8	**8**	-	**-**	5	**2**	2	**6**
CV:Na	98	**99**	5	**8**	157	**217**	12	**13**	5	**1**	5	**7**	2	**5**
CV:Il	95	**99**	2	**0**	145	**248**	6	**11**	2	**-**	2	**-**	2	**11**

Appendix C: Pre- Post Data- Written Response to Text

Name	Hawks Literal Jan	**Hawks Literal -March**	Hawks Inference-Jan	**Hawks Inference March**	Hawks Engagement January	**Hawks Engagement March**	Total score-Jan	**Total score-March**
Ro	3	**3**	4	**4**	3	**3**	10	**10**
Do	1	**3**	4	**4**	2	**3**	7	**9**
Jo	3	**3**	3	**3**	2	**3**	8	**9**
Li	0	**0**	0	**1**	3	**3**	3	**4**
Ria	0	**1**	2	**1**	2	**3**	4	**5**
Os	0	**0**	1	**3**	2	**3**	3	**6**
Mar	0	**0**	2	**1**	3	**2**	5	**3**
Car	0	**0**	0	**2**	2	**2**	2	**4**
Cel	1	**1**	2	**2**	3	**3**	6	**6**
Ame	0	**0**	2	**1**	3	**3**	5	**4**
Ta	1	**0**	0	**0**	1	**1**	1	**1**
Ril	0	**0**	0	**1**	2	**2**	2	**3**
Mat	0	**0**	1	**2**	1	**2**	2	**4**
Co:Ma	0	**3**	2	**4**	2	**3**	4	**10**
Co:Ga	1	**2**	1	**3**	2	**3**	4	**8**
Co:Mil	0	**0**	1	**3**	2	**3**	3	**6**
Co:Bo	0	**2**	3	**3**	3	**2**	6	**7**
Hi:Ja	0	**3**	0	**3**	3	**2**	3	**8**
Hi:Ch	3	**2**	2	**3**	2	**2**	7	**7**
Hi:Kh	0	**1**	2	**2**	2	**3**	4	**6**
CV:De	0	**3**	1	**2**	2	**3**	3	**8**
CV:Mi	0	**3**	1	**2**	2	**3**	3	**8**
CV:Na	2	**2**	0	**2**	3	**3**	5	**7**
CV:Il	-	**-**	-	**-**	-	**-**	-	**-**

Appendix D: Sample Lesson Plan-Day 4

Day 4

Mystery Texts

Introduce Mystery Texts (1 min)

"To understand what we read, readers use information they already know to fill in information that the author doesn't specifically write in the book. This is called making inferences. Today we are going to practice making inferences by finding and using clues in a mystery text. I'll read a sentence to you, and then you share what you are thinking based on the clues in the sentence. Then I'll read another sentence to you, and you can use clues in both sentences to tell what you are thinking. This mystery text has 7 sentences and the last sentence will reveal the mystery. See if you can figure it out."

Model (1 min)

"Watch and I'll show you how I use clues to think about the first sentence. The word 'these' makes me believe this is a thing or person or animal.

Guided Practice Making Inferences (5 min)

"What clues do you see in this first sentence?"

"For the second sentence, let's combine clues from both sentences and tell what we are thinking."

Read second sentence: "Share what you are thinking. There are no wrong answers."

Continue with each sentence to the end. Prompt after each sentence "What are you thinking? What makes you think that?" (This might be a good partner share time.)

Mystery Text

1.These are found in large sturdy trees and cactus.
2. However, they are not found year round like an eyrie might be.
3. The time of year depends on what state you live in, but even if you are in the right place at the right time, these will change after about 35 days.
4. Despite the short time frame, you might notice an eagle remaining in its nest to incubate these.
5. After that a baby eagle will hatch.
6. The hatchling will come out of an eagle's egg.

"Readers use clues as they read to make sense out of the reading. This is called making inferences. If you are reading and something doesn't make sense to you, think… 'What clues do I already know and what clues from other sentences in the text will help me figure this out?'"

Reading

Model Inference making in text (1 min)

"Turn to page 37 of Bald Eagles. I'm going to show you how I use clues to try to figure out an unknown word in my reading." Read the first sentence. "I'm not sure what the word 'scavengers' means. I'm going to read to the end of the paragraph to see if there are more clues." Read out loud to the end of the paragraph. "This paragraph is talking about food for eagles and whether this food is easy or difficult to find. Also, I know the word scavenger from going on scavenger hunts. That is when you find something that is hidden. Since the sentence says bald eagles are both hunters and scavengers I think scavengers is different from hunters because instead of working hard to go after and kill the animal for food, the eagle can find the food that is still and not moving. I'm going to keep reading and see if this makes sense of if I need to change the way I'm thinking."

Guided practice (2 min)
"There is another word in this sentence that is not very common. It is the word prey. Can you find it? Who can read the paragraph for us as we listen for clues for the word prey? What clues did you find? What do you think the word prey means? We could add both of these words to our chart of important words."

Independent practice (15 min)
"Keep reading about food, and see what you learn. Teacher coaches individual students in reading and thinking. "What are you thinking?"

Writing response (if time)
Spend a few minutes writing about your thinking today.

Appendix E: Sample Lesson Plan- Day 6

Day 6

Pre-reading

"Today we will be reading about another kind of raptor. This is the owl. Before we get started reading, let's think about what we already know about owls. It is okay if you don't know anything at all, or you know very little, or you know a lot already. Don't worry about spelling. Just do the best you can." (Use a blue pen)

"First make a list of words that come to mind when you think about owls." (3 min)

"Next, on a new sheet of paper, write these words again, but put them in groups by thinking about how some of these words are similar. Give each group of words a title to explain how they are similar, and add new words that fit any of the groups." (5 min)

"Now let's listen to what others have written. After everyone has shared, you can add to your poster based on what you learned. (3 min)

Reading

Introduction (1 min)

"Today we will be reading a story about owls based on a true story, called Adopted by an Owl. As you read, remember to use what you already know to help you understand what you are reading. I'll begin reading this story."

Model (2 min)

Read the first two pages and model your thinking in drawing on what you already know to help you understand the text.

Guided work or Independent work (16 min)

Students continue to read the story. Listen to students read one at a time and coach them with their thinking.

Appendix F: Mystery Texts

After each sentence ask students to share what they are thinking out loud and describe the clues that helped them think that. Encourage students to draw on prior knowledge and text based clues to make inferences. (Partners can share thinking with one another.)

Mystery Text (Day 4)
1.These are found in large sturdy trees and cactus.
2. However, they are not found year round like an eyrie might be.
3. The time of year depends on what state you live in, but even if you are in the right place at the right time, these will change after about 35 days.
4. Despite the short time frame, you might notice an eagle remaining in its nest to incubate these.
5. After that a baby eagle will hatch.
6. The hatchling will come out of an eagle's egg.

Mystery Text (Day 5)
1. For the first time, he was not in his nest and was frightened.
3. When he tried to move, he felt pain in his leg, and his leg was heavy.
4. Close by he saw a human, and behind the human he noticed strange tools and equipment.
6. The eagle was being treated for a broken leg in a rehabilitation raptor center.

Mystery text (Day 8)
1. It can be exciting to see an owl in the wild, but they are not always easy to find.
2. You might find evidence of owls from their living habits though.
3. When owls eat squirrels, skunks, rabbits, birds, snakes, insects, mice, and other creatures, the owls cannot grind or chew their food or digest the whole animal.
4. Consequently, they cough up the fur and bones of other animals they have eaten.
5. As a result, you might find owl pellets on the ground in the woods nearby where an owl lives.

Mystery text (Day 9)
1. This part of an owl is important to its survival.
2. Specifically, owls rely on this to hunt.
3. Owls can turn their heads to help them use these.
4. This key feature of an owl is hidden under feathers.
5. Owls have two of these and one is higher than the other.
6. The higher one helps the owl with sounds from above, and the lower one helps the owls from sounds below.
7. In conclusion, these are the owl's ears.

Mystery text (Day 10)
1. Both owls and eagles have these.

2. They are important for survival for all raptors.
3. More specifically, they give the owls and eagle grasping power to catch their prey.
4. If you touched them you would notice they are long, needle-sharp and curved.
5. They are talons, and they are an important feature of raptors.

Mystery Text (Day 13)

1. I am considered a bird of prey because I eat other birds and small animals.
2. My sharp talons, keen eyesight, and hooked beak help me hunt and capture prey.
3. One of my favorite foods is a pigeon.
4. No other creature can match my agility, speed and aim.
5. I am a peregrine falcon.

Mystery Text (Day 14)

1. You might be able to find me on top of a tall office building downtown Minneapolis.
2. Though I do not yet have a mate, I am not alone.
3. Since I am only a couple weeks old, I cannot survive yet on my own. I still need to learn how to fly and hunt for prey.
4. I am a nestling falcon called an eyas.