

ABSTRACT

PESOUT, ONDREJ. The Impact of Social Interdependence on Metacomprehension Training in Upper Elementary Classrooms. (Under the direction of Dr. John L. Nietfeld and Dr. Margareta M. Thomson).

Proficient reading comprehension provides an academic advantage for 21st century learners. However, students at the upper elementary level face increasingly challenging texts that require use of metacomprehension skills. Yet, there is a lack of formal instruction that assists students in practicing these metacomprehension skills in classrooms. Social interdependence theory (Johnson & Johnson, 1989) suggests that increased competitive and cooperative social interactions between students may have an impact on the acquisition of complex cognitive skills, such as reading comprehension and metacomprehension. The purpose of the current study was to examine the effects of social interdependence on both students' metacomprehension and reading comprehension. The study employed an embedded concurrent mixed methods quasi-experimental design to obtain both quantitative and qualitative data from students.

Students ($N = 184$) from fourth- and fifth-grade classrooms were assigned to one of four conditions varying in social interdependence: individual, competitive, cooperative, and intergroup competitive. A 2x2 factorial design was used to compare the effects of competitive and cooperative conditions on metacomprehension training. The training was conducted on eight short expository reading passages during class time and distributed over three school weeks. Findings from the study did not reveal any statistically significant differences between social conditions on students' reading outcomes. The data suggested that metacomprehension training had a positive impact on students' reading comprehension skills overall. Implications for this research suggest that future studies need to consider students' level of prior ability and motivation in their intervention designs.

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The Impact of Social Interdependence on Metacomprehension Training in Upper Elementary Classrooms

by
Ondrej Pesout

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APPROVED BY:

Dr. John L. Nietfeld
Co-Chair

Dr. Margareta M. Thomson
Co-Chair

Dr. Hiller A. Spires

Dr. Shevaun D. Neupert

BIOGRAPHY

Ondrej Pesout was born in a little mountain town Vrchlabí, Czech Republic in 1988. In the year 2007, he graduated from a small rural high school in Nový Bydžov and decided to study social science. His college years provided him with opportunities to travel, and he spent nearly one year studying at the University in Jyväskylä, Finland, and two months helping to educate children from disadvantaged families in Seoul, South Korea. Ondrej received his Masters' degree in Psychology from the Charles University in Prague, Czech Republic in 2012. At the same year, he was admitted to the Ph.D. program at North Carolina State University, where he began his research and work on metacognition and reading comprehension with upper-elementary grade children.

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CHAPTER ONE

Introduction

Proficient reading comprehension provides an academic advantage for 21st century learners (Murnane, Sawhill, & Snow, 2012). The national educational system in United States recognizes the importance of teaching reading comprehension at the elementary grades in both state and national policies (National Governors Association Center for Best Practices, 2010). However, there still remains a need for more evidenced-based reading comprehension instruction that meets high literacy standards for elementary-grade children (Williamson, Fitzgerald, & Stenner, 2013).

Reading experts agree students generally lack the ability to accurately assess their understanding of a given text (Paris & Flukes, 2005; Pressley & Ghatala, 1988). This prevents them from reading the text at a deeper level and from applying comprehension strategies that would improve their text comprehension (Graesser, 2007; Paris & Hamilton, 2009). Although students in upper elementary grades may relatively quickly reach their proficiency in basic reading skills, such as word decoding and reading, more advanced reading skills, such as text comprehension, require augmented practice (Reardon, Valentino, & Shores, 2012).

In an attempt to help students with difficulties in reading comprehension, scholars identified metacognition as a key set of skills and knowledge that students need to acquire in order to engage in strategic reading behavior (Baker & Brown, 1984; McNamara, Jacobina, & Allen, 2015). Systematic training in metacomprehension, which consists of metacognitive skills, such as monitoring judgments, can improve students' ability to accurately assess their

reading comprehension (Huff & Nietfeld, 2009; Thiede, Redford, Wiley, & Griffin, 2012). However, only few studies presented interventions designed to promote students' metacomprehension in upper-elementary reading classrooms (Bol & Hacker, 2012; Huff & Nietfeld, 2009). Moreover, the classroom studies that have examined students' practice of monitoring judgments have failed to consider important social and motivational factors, which may affect students' reading and metacognitive outcomes (Guthrie, Wigfield, & You, 2012; Slavin, 2013).

Theoretically, it has been argued that instructors can improve students' complex cognitive and metacognitive skills by embedding regular teaching instructions into socially enhanced learning environments (Aukerman, 2007; Kuhn, 2015). One method to capture the complexity of social influences is using the lens of the social interdependence theory (Deutsch, 1949), which suggests that social interactions established by either cooperative or competitive classroom structures can promote acquisition of advanced academic skills (Johnson & Johnson, 1989). While, many empirical studies support the beneficial effects of cooperative conditions on reading outcomes (Slavin, Lake, Chambers, Cheung, & Davis, 2009) and metacognition in upper elementary grades (King, Staffieri, & Adalgais, 1998; Kramarski & Dudai, 2009; Meloth & Deering, 1994), little research documents the effects of competitive learning environments on reading comprehension (e.g., Bolocofsky, 1980). The available evidence suggests that a mix of both cooperation and competition has the potential to yield promising results in students' acquisition of advanced academic skills (Clark, Tanner-Smith, & Killingsworth, 2016; Tauer & Harackiewicz, 2004; Vrugte et al., 2015).

However, due to lack of empirical studies that would directly examine the effects of social interactions on students' metacomprehension and reading comprehension outcomes, it is not clear whether increased social interdependence among students improves the acquisition of students' metacomprehension. Therefore, the current research study examines the impact of social interactions on metacognitive monitoring of comprehension in the upper elementary grade classrooms.

Study Purpose

The purpose of this study is to examine the social interdependence framework in the context of metacomprehension training situated in a natural classroom environment. More specifically, the study investigated the impact of competitive and cooperative social settings on students' reading and metacomprehension outcomes in the fourth- and fifth-grade classrooms. Over the course of four weeks, students took part in metacomprehension activities that promoted the accuracy of their comprehension judgments (Huff & Nietfeld, 2009). The study examined the impact of researcher-designed training conditions varying in their social interdependence on the development of students' metacomprehension and their reading comprehension skills. Furthermore, as research suggests that the acquisition of metacomprehension and reading comprehension skills can be influenced by dispositions and motivation factors (Schiefele, Schaffner, Moller, & Wigfield, 2012), the current study also explored the effects of motivation and prior abilities on students' outcomes.

CHAPTER TWO

Literature Review

The following literature review is divided into three sections. The first section overviews the concept of reading comprehension and the factors that need to be considered when researchers examine interventions designed to improve reading comprehension. The review particularly emphasizes the role of metacognition in reading comprehension, therefore, the later part of the first section describes the concept of metacomprehension and ways it can be systematically improved in classroom environments. The second section introduces the theory of social interdependence and discusses its two main components: competition and cooperation. To do this, hypothetical situations are related to social contexts in which students learn reading comprehension and metacomprehension skills. Finally, the third section reviews methodological approaches to classroom-based interventions that address students' social interactions within classroom environment.

Reading Comprehension

Teaching reading is a high priority in formal schooling because reading is essential for academic success in other disciplines including mathematics, history, and science (Lee & Spratley, 2010; Piercy & Piercy, 2011). The current world is driven by accelerated flow of information and requires individuals to have more advanced literacy skills than ever before (Murnane et al., 2012). Current generations need more instruction that increase the acquisition speed of literacy skills to keep up with the changes in the labor market and globalization of economies (Murnane et al., 2012; Noddings, 2005). Scholars believe that

reading comprehension can be a gateway towards the formation of complex thinking and reasoning skills necessary for participation in the current democratic society (Noddings, 2005). However, despite agreement that reading is a national educational priority, discussions on the most appropriate instructional methods are ongoing (Williamson et al., 2013).

The increasing demands on reading comprehension skills are reflected in high standards for reading at upper-elementary grade levels, apparent in both annual statewide and nationwide testing policies (Hiebert & Mesmer, 2013; NGACBP, 2010). In the recent five years, progress in reading comprehension instruction was minimal compared to the progress in mathematics instruction assessed at the elementary grade level (National Center for Educational Statistics, 2015). Therefore, there is a need for more evidence-based research practice to identify the most efficient instructions.

Components of Reading Comprehension

Reading comprehension is a complex process that is not easy to define, much less to teach and assess (Randi, Grigorenko, & Sternberg, 2005). One reason for the complexity of reading comprehension is the sheer subset of reading skills that make up reading comprehension. Reading comprehension comprises a large number of reading skills, including word decoding, phonemic awareness, inference making, etc. The ‘simple view theory’ (Hoover & Gough, 1990) provides basic distinction between ‘lower-level reading skill’ considered as reading fluency and ‘higher-level reading skills’ referred to as listening comprehension. Lower-level reading skills consists of basic skills, e.g., phonemic awareness, word decoding, and understanding morphological structure, higher-level reading skills

encompass listening comprehension, inference making, and comprehension monitoring (Hogan, Bridges, Justice, & Cain, 2011). The theory posits that reading comprehension is a function of skills at both levels. Therefore, children are not able to comprehend text unless they can decode words and before they possess sufficient listening comprehension skills (Hoover & Gough, 1990).

Easy texts can serve as a practice ground for training lower-level reading skills. Once students increase their morphological awareness, enhance their speed, and accuracy in letter identifications, they will become fluent in word decoding, and practice their comprehension (Pikulski & Chard, 2005; Rueda-Sánchez & Bastida-Lopez, 2016). However, readers do not enhance their higher-level reading skills in the same way as their lower-level reading skills, they need texts with increased structural and verbal complexity, which require a different instructional approach than easy texts, especially when the text complexity increases in upper-elementary grades (Pressley & Gaskins, 2006). This was evidenced by findings that students who read at an average level in third-grade classrooms did not become automatically proficient in text comprehension in the later grades (Snow, 2002). According to Kintsch and VanDijk (1978), reading comprehension is more than word decoding or reading fluency. Rather, reading comprehension is an ability to construct a meaning from the text, which requires an active interaction between the reader and the text. Readers have to construct an accurate mental representation of the text and integrate it into their mental structure in order to assign a personal meaning to the text (Kintsch & VanDijk, 1978; Kintsch & Vipond, 2014). Based on this definition, students must engage in active interaction with the text, build on

their prior knowledge, and exert a mental effort that helps them to integrate necessary details into main text idea conveyed by the author of the text.

Reading Comprehension as Text Construction and Integration

Readers commonly construct multiple representations while reading a text, especially when texts difficulty increases (Irwin, 1991; van den Broek & Kremer, 2000). When a student reads about unfamiliar topic, the text might include words or sentence parts that at the first glance do not connect; the student cannot create a coherent text representation in her or his mind (*e.g. when student encounter an unfamiliar word like 'heterogenous,' the student will struggle to connect to simpler words that student knows, like 'same,' or 'different'.*). Therefore, the student needs to make inferences about the textual meaning that need to be validated to fully comprehend the main idea of the text. These tasks do not come naturally to students and require complex cognitive processes. The meaning of the text commonly rests at multiple levels of its written message: e.g., word level, sentence level, text level (Baker, 1985).

Multiple reading processes improve construction and integration of the text. For instance, students' large vocabulary can account for the word level of the text, because the word level is necessary, and students will benefit from knowing all the words in the text. However, if students are not be able to connect the words into a meaningful idea, the large vocabulary alone is not sufficient to ensure a comprehension of the entire text (Cain, Oakhill & Lemmons, 2004). Therefore, readers must also engage in processes that construct meaning at both the sentence and the text level (Irwin, 1991; van den Broek & Kremer, 2000). This

need for multiple representations at all text levels requires readers constantly update their constructed meanings of written message, and integrate them into a single coherent representation (*e.g. word 'heterogenous' commonly appears in the reference of text describing 'differences'*). Students' prior reading abilities, background knowledge, level of engagement, and the use of higher order thinking can improve such reading process.

Prior knowledge. At first, the text representations are directly formed by prior knowledge, which aids readers in building a sense of understanding as meaning is constructed. At both the sentence and the text level readers must connect the information about the text to their prior knowledge (Anderson, 1984; Nagy, Herman, & Anderson, 1985). Based on the prior knowledge, the readers make inferences and organize information about the text into meaningful units while reading (Pearson & Johnson, 1978; Raphael, 1986). Dole, Valencia, Greer, & Wardrop (1991) demonstrated that background knowledge was an important factor for comprehension of instructional material. Several experimental reading intervention studies improved students' reading comprehension by extending students' background knowledge (*e.g.*, Miller, Cohen, & Wingfield, 2006; Spires & Donley, 1998). More specifically, one study showed that the knowledge about context of the text reduced the demands on working memory capacity during reading (Miller et al., 2006), in addition, students who learned how to activate their prior knowledge were better able to identify the main idea of the text compared to the control condition (Spires & Donley, 1998).

Basic reading skills. Readers must use attention to check whether words are decoded accurately and phonetically match their semantic meaning (Hogan et al., 2011). Empirical

evidence has shown that attentional control significantly contributes to reading comprehension in addition to reading skills and knowledge (Conners, 2009). Nevertheless, human attention has limited cognitive capacity (Baddeley & Hitch, 1974). Therefore, developing automaticity in the basic word reading skills is substantial for the development of higher level reading skills (LaBerge & Samuels, 1974). With extended practice readers can become more automatic in controlling their attention. From this, they can reduce the need to spend cognitive resources on decoding words and use their attention on other reading tasks (Stanovich, 1990). Thus, basic reading skills, such as reading fluency and listening comprehension, are the building blocks of reading comprehension (Hoover & Gough, 1990).

Level of engagement. Although some readers possess both background knowledge and basic reading skills, they may still read texts at a shallow level and, as a result, comprehend very little information (Connell, 2008). The transactional view of reading assumes that readers have to be actively engaged in drawing a meaning from the text when they read, for instance they should strive to have a dialogue with authors' ideas (Rosenblatt, 1978). Regardless of whether the reader's purpose is to seek information or read for pleasure, an exerted effort will aid the text comprehension (Guthrie & Wigfield, 2000). Teacher ratings of student engagement in reading tasks mediated those students' gains in reading comprehension from structured reading comprehension instruction (Wigfield et al., 2008).

Metacognition. Skilled readers engage in more complex cognitive processes, such as metacognition (Pearson, 2009). Metacognition governs readers' decisions about text reading, e.g. whether to pause and reread a portion of the text or read on and draw meaning later.

Metacognitive skills also alleviate students' difficulty with organizing multiple meanings; as through such processes, students can compare the correspondence between multiple text representations and identify misalignments between them (Griffith & Ruan, 2005). Such mental coordination requires increased cognitive capacity (Cain et al., 2004). Moreover, these skills do not come to readers naturally, but they must be learned through interaction with the text accompanied with formal instructions (Schneider, 2010). Therefore, it is advisable to initiate the instruction of metacognition after students acquired lower-level reading skills and learned them to the point of automaticity. Well-rehearsed fluency and sheer vocabulary facilitates development of metacognition (Pressley, 2000). In the upper-elementary grade, when word-reading skills are consolidated educational researchers can shift their attention to reading comprehension instruction of more complex texts (Pressley & Gaskins, 2006).

Factors that Affect Reading Comprehension

Students' interactions with the text and reading comprehension outcomes can be affected by numerous factors (Artelt, Schiefele, & Schneider, 2001; Share, Jorm, Maclean, & Matthews, 1986; Snow, 2002) that can be divided into three parts based on their origin: person, task (text), and context (Pearson, 2009). The personal characteristics that affect readers' comprehension may range from their cognitive dispositions (e.g. working memory) (Seigneuric, Ehrlich, Oakhill, & Yuill, 2000), to their affective states (Athey, 1982). Certain personal characteristics have an impact on the process of text construction and integration, such as metacognition (Baker & Brown, 1984; Pressley, 2000), prior knowledge (Rumelhart,

1984), students' interest (Artelt et al., 2001; Schiefele, 1996), and other motivational correlates with readers' engagement in the text (e.g., self-efficacy, Schunk, 2003; goal orientations, Guthrie & Wigfield, 2000). Metacognition builds on students' expertise with texts, which can range from knowing a large amount of reading strategies (Graesser, 2007) to using an appropriate strategy during a reading task (Pressley & Afflerbach, 1995). Readers who are more proactive, and engage in strategic behavior demonstrate superior comprehension skills compared to passive readers (Paris & Flukes, 2005).

The task characteristics relate to not only the goals and purposes of the text, but also to its features, such as syntax, word choice, structure, or genre (Snow, 2002). Educators have been long concerned with the challenge of providing readers with texts that match their abilities, and nearly 50 readability formulas have been developed since 1920 to address this issue (Crossley, Greenfield, & McNamara, 2008). Using algorithms, e.g. Flesch-Kincaid readability index, researchers can compute syntactic and lexical complexity and generate an index of text difficulty. These formulas are highly correlated with reading comprehension ($r \sim .80$) (Chall & Dale, 1995). However, a common criticism is that the traditional formulas assess only the surface level of the text (e.g. sentence length, word commonality), ignoring its deeper structure, such as text cohesion, or meaning construction in its estimation of text complexity (Koda, 2005). Recently formulas, such as Lexile or Coh-Metrix attempt to overcome this criticism by calculating sentence cohesion, and textual structure (Graesser, McNamara, Cai, Conley, & Pennebaker, 2014). However, the readability indices face much stronger criticism from the field in that they cannot account for factors that are inherent in

person or interaction between the reader and the text, which also contribute to text difficulty (Graves & Graves, 2003).

As another characteristic of the text, text genre may also impact comprehension of a reader. The simplest distinction in text genre is made between fiction (narrative) texts and non-fiction (informational) texts; both have a specific text structure. Students who are not aware of the basics of the text structure may struggle in text comprehension, especially with nonfiction texts (Meyer & Rice, 1984). Although comprehension performance of non-fiction texts seems to be a more reliable predictor of future verbal abilities (McCreath, Linehan, & Mar, 2017), the educational system in the United States has been determined to promote reading of non-fiction informational texts (Moss, 2008). The practice of reading informational texts in elementary grades is believed to improve literacy in other domains of academic skills, which may help students in their future academic performance (Benson, 2002).

The circumstances under which readers interact with the text can be seen as context. Inevitably, one will find differences between reading in an organized classroom setting and home reading (Rowe, 1991). The predictors of literacy in home environments seem to be more pertinent to the parental interactions with children (Baker, 1994; Dickinson & Tabors, 2001). Literacy supportive home environments are commonly associated with parental socioeconomic status and access to books (Bergen, van Zuijen, Bishop, & de Jong, 2017; Korat, Klein, & Segal-Drori, 2007; Sanders, Zacur, Haecker, & Klass, 2004). Readers in stimulating home environments manifest more reflective and purposeful reading behavior

(Schneider & Pressley, 1997). Nevertheless, evidence shows that in general readers benefit from structured classroom environment at a larger magnitude (Crone & Whitehurst, 1999).

However, contextual conditions that influence readers' performance may largely vary within schools. For instance, students approach a graded reading comprehension task in a different way compared to an ungraded task (e.g., a book club). The reader's goals change with the circumstances in the environment. Although recent investigations became more interested in classroom reading environments, enriched with technology (Schmar-Dobler, 2003), game situations (Godwin-Jones, 2005), and also with the presence of other individuals (Lundeberg & Mohan, 2009), the effects of these contextual factors on reading comprehension remain underexplored. In order to explore this gap in literature further, the goal of the current study is to examine the effects of social contexts in the organized reading classroom environments on reading comprehension skills.

Metacognition

Flavell (1979; Flavell et al., 1993) coined the term metacognition, which refers to any knowledge or mental activity that took its cognition as an object, or regulated any cognitive activity (Flavell et al., 1993, p.150). Metacognition can be divided into two main components, metacognitive knowledge and metacognitive regulation (Baker & Brown, 1984).

Metacognitive knowledge refers to the knowledge about one's own mental activity, and metacognitive regulation refers to any mental acts that use metacognitive knowledge to complete the task at hand (McCormick, 2003).

In the context of reading, metacognition can relate to the actions of readers who engage in it when actively thinking about, or reflecting on the reading process. Allen and Hancock (2008) wrote “successful text comprehension involves metacognition, which is the active management of meaning creation through a process of mediation between reader, text, and context factors” (p.125). To list few examples of the use of metacognition in reading behavior: metacognition can be described as a decision to expend more efforts to comprehend certain parts of the text, use of techniques that can reduce mental effort while reading text, identification of a bias in text reading, and interpretation of the impact of one’s own bias.

Metacognitive Knowledge

The concept of metacognitive knowledge has been recognized as a useful construct that shed light on what readers know about the process of reading (Baker & Brown, 1984; McCormick, 2003). Early research, also known as metamemory research, focused on students’ ability to accurately mentally represent the text, which was originally attributed mainly to text characteristics (Maki & Swett, 1987; Weaver & Bryant, 1995). Later on, scholars started to differentiate between three types of metacognitive knowledge, described as declarative, procedural, and conditional metacognitive knowledge (Jacobs & Paris, 1987). Declarative knowledge refers to knowledge that a person may have about his or her abilities and about the salient learning characteristics that affect cognitive processing. Procedural knowledge refers to knowledge of how to execute procedures such as learning strategies. Conditional knowledge refers to knowledge about when and why to use procedures or

strategies (McCormick, 2003). Although this classification was found as most prevalent in the literature, other distinctions between metacognitive knowledge were considered too. For instance, Flavell (1979) proposed that metacognition could be divided into knowledge about a person, knowledge about text, and knowledge about reading strategies.

Metacognitive Regulation

As research in metacognition has progressed, scholars have steered their attention to investigation of metacognitive regulation. Metacognitive regulation is viewed as a complementary component of metacognitive knowledge (Paris & Winograd, 1990). Metacognitive regulation describes the reader's engagement in metacognitive activity either during, prior or after the task (Desoete, Roeyers, & DeClerq, 2003). Metacognitive regulation include at least three distinct phases: planning, monitoring, and evaluation. These phases do not have to be directly sequential and can have different roles based on the genre and type of the text (Jacobs & Paris, 1987).

Interaction Between Metacognitive Knowledge and Metacognitive Regulation

Although the function of metacognition was commonly represented on a static model (Jacobs & Paris, 1987), the interaction between metacognitive knowledge and metacognitive regulation during engagement in task are considered dynamic (Flavell, 1979). The interactions between the two metacognitive components are described as reciprocal. Metacognitive knowledge informs the use of metacognitive regulation. Metacognitive regulation forms and shapes the reader's knowledge about the text, as well as her or his

strategies to represent the text accurately (Baker & Brown, 1984; Brown, 1980). Therefore, Nelson and Narens (1990, 1994) outlined the dynamic nature of both metacognitive components in their model of metacognition: meta-level and object-level (See Figure 2.1).

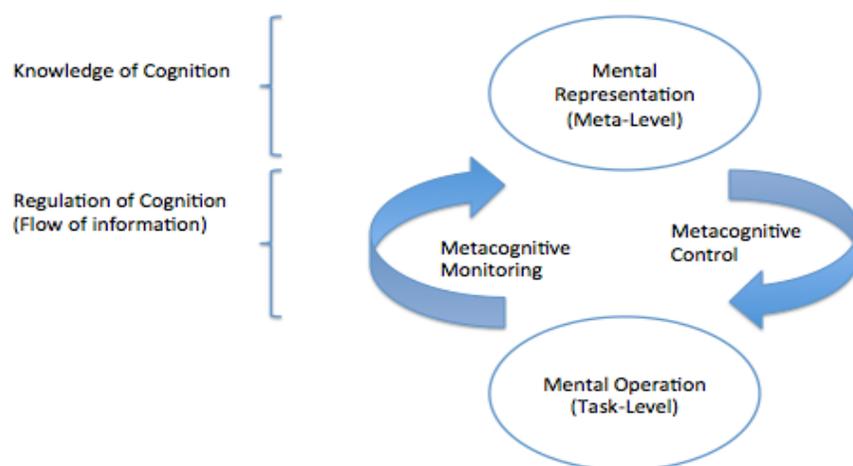


Figure 2.1. Theoretical framework of metacognition adapted from Nelson, T.O. & Narens, L. (1990). *Metamemory: A theoretical framework and some new findings*. In G.H. Bower (Ed). *The psychology of learning and motivation*, 26, (pp.125-173). New York: Academic Press.

In the context of reading comprehension, the object-level relates to readers' activities with a text while the meta-level relates to readers' understanding of their own text processing. The construct of metacognition maintains the flow of information between the two levels with two processes; monitoring and control. Information transferred from object-level is called 'monitoring' which informs the meta-level about the current status of the task (e.g., the fluency of comprehension). 'Control' describes the direction of the information transferred from the meta-level to the object-level. This can modify the state of the object-level, carrying implications on the individual's actions associated with the task (e.g., inference that reader makes about what is going to be next in the following paragraph).

Schraw and Moshman (1995) hypothesized that learners create theories about their own cognition on the meta-level. These theories may vary in the extent to which they are explicit to reader and integrated with other cognitive structures. At first, readers may have an implicit, fuzzy, and isolated cognitive structure, called a 'tacit theory'. The tacit theory is sufficient, until an emergence of a complex task that requires individual to change her or his way of thinking and representing the task. The maladaptivity of the theory may hinder future learners' progress. In contrast to tacit theories, informal theories are explicit. Informal theories form beliefs or assumptions of which learners are aware and readers can deliberately change them. However, the informal theories do not fully integrate with other forms of beliefs and cognitive structures. Formal theories are explicit, highly systemized, and readers can directly observe and assess the usefulness of their cognitive representations, modifying them as needed. Both Schraw and Moshman (1995) emphasized that these theories develop through individual's learning process. However, this development can be affected by culture and peer interactions in a social environment. The presence of other individuals helps readers to clarify their view of the construction of metacognitive knowledge through reflection of readers on their thinking processes. Specifically, when readers are prompted to interact with other individuals, they have to make their thinking process more explicit, which also allows other individuals to inspect their thinking process and compare it with the thinking of their fellow individuals (Cornoldi, 1998).

Metacognitive Judgments

As described before, metacognitive monitoring functions to update an individual's mental representation of the current state of the task, whereas metacognitive control implements efficient strategies to aid mental operation while completing the task. Through the process of monitoring, individuals make judgments to evaluate their current state of knowledge and determine the efficiency of their strategies (Tobias & Everson, 2002). Accurate metacognitive judgments relate to less erroneous behavior committed during the task (Van Loon, de Bruin, Van Gog, & Van Merriënboer, 2013; Vrugt & Oort, 2008) and increased performance evidenced across multiple fields (Desoete & Roeyers, 2006; Maki, 1995; Pilegard & Mayer, 2015). However, individuals have a tendency to make biased judgments (Lieberman & Tversky, 1994), which do not match their learning and performance accurately (Hacker, Bol, & Keener, 2008).

Students who use metacognitive control during text reading can accurately monitor their reading process and make judgments about their understanding or misunderstanding of the text (Maki & Berry, 1984). As individuals mature, they become more proficient in their use of metacognitive monitoring. For instance, students' metacognitive judgments are considerably more accurate among fifth-graders compared to third graders (Pressley & Ghatala, 1990; Roebbers, Krebs, & Roderer, 2014; Roebbers, Schmid, & Roderer, 2009). Although older children are more likely to accurately assess their performance, likely due to their increased cognitive capacity, even adults' judgment accuracy is far from perfect and they, too, would benefit from a training in metacognitive skills (Baker, 1989). Therefore,

many arguments supporting the systematic introduction of the metacognitive instruction in school curricula highlight its positive impact on wide range of academic skills among readers of all ages, particularly benefitting less skilled readers (Pressley & Gaskins, 2006).

Metacomprehension in Reading Comprehension

The act of monitoring of one's own textual understanding is called metacomprehension (Dunlosky & Lipko, 2007; Maki & Berry, 1984). Unfortunately, students do not always engage in comprehension monitoring and if they do, their metacomprehension judgments are often inaccurate (Glenberg & Epstein, 1985; Pressley & Ghatala, 1988; Pressley, Ghatala, Woloshyn, & Pirie, 1990). Although some scholars believe that comprehension monitoring in reading unfolds naturally as children grow older (e.g., Schoonen, Hulstijn, & Bossers, 1998), a larger body of literature suggests that the acquisition of metacognitive knowledge and skills occurs due to the numerous cognitive tasks completed in schools with the correlation between metacognitive development and age merely shadowing years of schooling (e.g. Kron-Sperl, Schneider, & Hasselhorn, 2008; Schneider, 2010). This is further supported by evidence showing that metacomprehension skills typically do not improve in classrooms without specifically targeted interventions (Schraw, Potenza, & Nebelsick-Gullet, 1993; Thiede et al., 2012). Therefore, in order to promote metacomprehension in classrooms, researchers suggest explicitly teaching reading comprehension strategies (Graesser, 2007).

Fostering Reading Comprehension through Metacomprehension

Graesser (2007) argued that there are at least three ways in which active comprehension monitoring can help students in their text understanding: first, students become consciously aware of whether or not they adequately comprehend the text (Glenberg & Epstein, 1985). Second, students are less likely to experience an overconfidence bias, which causes them to read texts at a shallow level rather than engage in comprehension (Baker, 1985; Otero & Kintsch, 1992). Finally, readers can activate background knowledge, which can help them to interpret challenging technical terms, hampering their overall text understanding (Best, Rowe, Ozuru, & McNamara, 2005).

However, some empirical evidence argues that teaching explicit reading strategies compared to practice of reading skills may alienate students from the context of reading itself (Beck, McKeown, Hamilton, & Kucan, 1997). Teaching explicit reading strategies did not result in improvements in reading comprehension when compared to reading practice, unless the strategies were specifically related to the given text and practiced in conditions in which the reading activity took place (McKeown, Beck, & Blake, 2009). Moreover, there is a growing concern that the current literacy instructions put too much emphasis on teaching and testing the use of strategies as opposed to allowing students to focus on the content of the text (Willingham & Lovette, 2014). Students cannot engage in comprehension monitoring and hone their metacomprehension judgments if they are concerned with applying the correct strategies rather than constructing a personally relevant meaning of the text during their instructional time (Hogan et al., 2011). Since teachers employ reading comprehension

strategies in their instruction (Ness, 2011), researchers question whether students' metacomprehension also prospers in literacy classrooms (McKeown, Beck, & Blake, 2009).

Another approach to increase students' metacomprehension is through a practice of metacomprehension judgments. The evidence shows that students who engage in making monitoring judgments related to classroom material and are supplied with corrective feedback improve the accuracy of their monitoring judgments (Huff & Nietfeld, 2009; Nietfeld, Cao, & Osborne, 2006). Moreover, students who demonstrate more accurate metacomprehension judgments demonstrate a tendency to make more appropriate choices in reading tasks (e.g., selecting books that match one's own skill level, applying reading strategies effectively) (Thiede, Anderson, & Therriault, 2003; Thiede et al., 2012).

Measurement of Metacomprehension

Accurately and reliably capturing the ongoing comprehension monitoring processes while reading has been challenging for metacomprehension researchers (Norman, Price & Duffy, 2010). Although various methodological approaches measure the construct of metacomprehension, several authors cautioned that the use of different methods might lead to depicting different aspects of metacognitive monitoring (Fletcher, Molfese, Simos, Papanicolaou, & Denton, 2011; Schraw, 2009a; Schraw, Kuch, & Gutierrez, 2013). The most common approaches to measuring metacomprehension are being reviewed.

Measurement of subjective responses. Early methodological practices speculated the involvement of comprehension monitoring in reading by using self-reported data, e.g. interviews (Paris & Jacobs, 1984;), surveys (Jacobs & Paris, 1987; Schmitt, 1990) or verbal

protocols (Pressley & Afflerbach, 1995). Initial work aiming to understand the most basic components of metacognition (as it is known today) relied on the techniques of interviews, recording how upper elementary students employ their metacognitive processes while reading a text, and how these processes developed over time (Paris & Jacobs, 1984). Based on the observations made during these interview, inventories were developed asking students to rate their metacognitive interactions with the text (Jacobs & Paris, 1987). Inspired by this approach many scholars in the field developed their own instruments of self-reported metacognition (Mokhtari & Reichard, 2002; Schmitt, 1990; Schraw & Dennison, 1994; Sperling, Howard, Miller, & Murphy, 2002).

On one hand, the interviews can reveal many aspects of the processes and explore the specific phenomena that interest researchers. On the other hand, use of inventories to record subjective responses have the advantage that respondents' answers can be easily quantified. However, both methodologies have limitations in their accuracy. A common criticism of both methods is that they use subjective responses, which can be influenced by errors in cognitive functioning, such as memory retrieval, biases, and the limitation that automatic cognitive processes are inaccessible to conscious experience (Sudman, Bradburn, & Schwarz; 1996).

Methods used as an alternative to interview or survey are think-aloud protocols that allow researchers to record individual's verbalized thinking while they are reading a text (Hilden & Pressley, 2011). This method provides immediate access to individual's content of one's thinking during the task. Original work that used think-aloud protocols was intended to explore how experts solve routine problems (Ericsson & Simon, 1984). For example,

Pressley and Afflerbach (1995) identified and described expert readers' use of metacognitive processes and strategies when they approached a text. However, when this method was used on novices or with children, the extra task of verbalizing one's own thinking caused an external cognitive strain on information processing and disrupted both the natural process of reading and metacognition. As a result, the obtained responses are skewed, especially for younger readers (Hilden, 2008; Vandeveld, van Keer, Schellings, & Van Hout-Wolters, 2015).

Performance based assessment of metacomprehension. In contrast to self-reported data, specific task based assessments make inferences about metacomprehension by gauging students' responses on tasks that require comprehension monitoring (Ellis, 2003; Wagoner, 1983). The most common performance based assessment in the literature is the error-detection task where students are assessed in their ability to detect erroneous information embedded in a text (Winograd & Johnston, 1982). However, the methodology cannot be used with just any text, but rather specifically adapted reading material because the errors must be carefully implanted in the text.

Calibration judgments as measurement of metacomprehension. Calibration of comprehension (Glenberg & Epstein, 1985) became an established method of measuring the accuracy of metacomprehension judgments. Calibration is the extent to what an individuals' subjective performance correspond to her or his objective performance. This method combines the advantage of subjective response and objective task and capitalizes on the framework of metacognitive monitoring processes. The task is administered by assigning

subjects a text on which they are asked to what extent they are confident that they understood the text (Nelson & Narens, 1990; Schraw, 2009a). The discrepancies between subjective judgments and objective performance on tests are calculated across set of items, which results in a calibration index or metacomprehension index (Glenberg & Epstein, 1985; Lin & Zabrocky, 1998; Schraw, 2009b).

Many approaches exist to compute accuracy of metacomprehension judgments (Schraw, 2009a). The aspects of measured by metacomprehension judgments are based on researchers' choice of objective standards to which the individuals' subjective judgments are compared. Schraw (2009b) provided a framework that presented five possible computations of metacomprehension judgments: Calibration accuracy, Relative accuracy, Response bias, Discrimination, and Scatter index. Discrimination and scatter indices capture the differences in individual's judgments in their correct and incorrect responses. Discrimination assesses the ability to discriminate between the correct and incorrect answer, whereas scatter computes the degree of variability for both correct and incorrect answers. The measures of the latter two indices depend on the number of items and variability in their difficulty. Both calibration and relative accuracy measure the extent to which students' judgments deviate from their performance. While calibration is a judgment of precision and focus on the absolute value of this difference, relative accuracy gauges what level students' monitor their performance discrepancy from item to item level. Therefore, relative accuracy is more dependent on variation of the difficulty of comprehension items, and the measure increases with the item quantity in the test. In contrast, calibration accuracy would be more appropriate measure in

testing conditions where less items are presented. In addition, response bias measures the direction of the judgment, i.e., whether individual overestimates or underestimates her or his performance whereas, discrimination, scatter, and relative accuracy require large variance in responses in order to compute the indices accurately. On the other hand, calibration accuracy and response bias do not require large variability of responses and can be computed on small number of items, which is more suitable for brief testing conditions.

Calibration judgments are susceptible to the way testing conditions are framed (Pressley, Ghatala, Woloshyn & Pirie, 1990) and homogenous conditions across tasks are recommended (Thiede et al., 2009). Generally, the accuracy of students' calibration judgments is higher when multiple judgments on the text are provided (Weaver & Bryant, 1995), when the judgments are made after reading the text rather than prior to the reading (Glenberg & Epstein, 1985), and when the given text is easy rather than difficult (Lin & Zabrocky, 1998). However, there are situations when it is desirable to purposefully increase the difficulty of calibration judgments or have students make predictions about their text comprehension (Rawson & Dunlosky, 2002).

Technological advancements in measurement of metacomprehension. With the expansion of technologies, alternative approaches in measurement such as eye tracking or neuroimaging occurred to the researchers as option to examine metacognition in literacy. However, these methods are still currently finding their place in the field of reading comprehension research and need to be validated against more established methods (Baker, Zeliger-Kandasamy, & DeWyngaert, 2014; Fletcher et al., 2011; Roderer & Roebbers, 2010).

In general, there are many options in measurement of comprehension monitoring and all of them have their own disadvantages. The selection of the most appropriate method requires researchers to consider the focus and conditions of the study. Insofar, the method of calibration judgments seems to be a cheap and simple technique that combines the benefits of obtaining subjective responses, while also using objective standards that are easy to quantify. Each method represents some reduction in the observed phenomena and might not be assessing the same construct as another method. The current study will use the calibration judgments and interviews to collect data on metacomprehension.

Classroom Interventions that Promote Metacomprehension

The main purpose of interventions in reading is to increase students' awareness of their interactions with the text (Baker & Beall, 2009). The majority of successful reading interventions used explicit strategy instructions in order to allow students to discuss, model, and practice their thinking (Dessus et al., 2012; Duke & Pearson, 2008; McNamara, 2004; Pressley et al., 1992). However, this form only focuses on one aspect of metacognition, with instruction capitalizing on students' metacognitive control of information in reading the text. In order to promote wider metacognitive processes, metacognitive instructions also need to focus on metacognitive monitoring, or metacomprehension, when referring to reading (Baker & Brown; 1984; Flavell, 1979; Maki & Berry, 1984; Nelson & Narens, 1990).

To date, only a small number of intervention studies have successfully increased students' metacomprehension judgments. In initial studies, researchers trained student's monitoring performance using comprehension outcomes as measures of effectiveness.

For example, Miller (1985) trained fourth grade students in their text understanding based on the error-detection paradigm. Five self-instruction statements were used as prompts before each text trained students in comprehension monitoring. Students who self-instructed themselves during reading the text improved their ability to detect errors in text. In another study, Ghatala and his colleagues (Ghatala, Levin, Pressley, & Goodwin; 1986) designed three-component training to improve monitoring of students' strategy use. They showed that even seven to eight years old children could be taught to monitor the relative efficacy of their strategies. These studies did not observe the accuracy of metacomprehension judgments as outcomes; rather, they trained student's monitoring performance while focusing only on comprehension outcomes.

There are considerable challenges to introducing metacomprehension instructions into classrooms. Some scholars (Baker, 1985; Thiede, Griffin, & Wiley, 2011) found that readers' use of inappropriate cues to assess their comprehension causes their imperfect metacomprehension. For instance, elementary aged children commonly base their judgments of comprehension on how easily they can recall the parts of the text (Thiede et al., 2011), while they infrequently make judgments about consistency of individual propositions in the text (Baker, 1985). The cues that readers use to make judgments about their understanding of the text differs from the cues that relate to their true text understanding, or at least from the way they are tested on comprehension (Thiede et al., 2011). Therefore, students need a corrective feedback to adjust the cues they are using for their judgments (Huff & Nietfeld, 2009).

Another challenge in promoting students' metacomprehension rests on the fact that students' judgments are stable and do not change easily over time (Finn & Metcalfe, 2014). In order to improve their judgments, students need to be exposed to repeated practice (Koriat, 1997). Students often prefer massing practice, as they attempt to learn material and rehearse skills in one lengthy study session (Toppino, Cohen, Davis, & Moors, 2009). However, instruction that includes longer intervals between study sessions provides students with larger improvements both in metacognitive monitoring and in metacognitive control (Bahrick & Hall, 2005; Son & Simon, 2012).

Despite considerable challenges with implementing an effective instruction to improve the accuracy of monitoring judgments, only few interventions have successfully improved students' metacomprehension. These interventions prompted students to reflect on their performance to activate their metacognitive monitoring processes (Cleary, Platten, & Nelson, 2008; Nietfeld, Cao & Osborne, 2005, 2006).

For instance, students who engaged in curriculum that emphasized self-reflection and explicit thinking while reading demonstrated higher accuracy in their metacomprehension judgments on complex reading inference skills (Thiede et al., 2012). Huff and Nietfeld (2009) designed a two-week intervention that enhanced students' metacomprehension in fifth-grade classrooms. Researchers employed distributed practice of calibration judgments with immediate feedback provided to students about their accuracy. The instructor (Huff) modeled how she monitored her comprehension and how she corrected emerging misunderstandings by 'fix-up' strategies while reading a text. Students in the training conditions demonstrated

better accuracy in metacomprehension judgments, but they did not show significantly better performance on a standardized reading comprehension test than their peers in the control conditions. The only difference between the two tested training conditions showed that the students with additional prompts increased their overconfidence in their ability to assess their text understanding at the end of the study.

More studies that address students' metacomprehension judgments in classroom environment are needed, as they provide a valuable insight into students' metacognitive monitoring skills in reading. Furthermore, little is known how social environment could alter metacomprehension judgments and its effects on reading comprehension performance. For instance, social interactions were repeatedly shown as an effective instructional format in reading comprehension (e.g. Klingner & Vaughn, 1998; Palincsar & Brown, 1984; Rohrbeck, Ginsburg-Block, Fantuzzo & Miller, 2003). On the other hand, Anderson, Thomas and Nashon (2009) reported in their case study that some learning in cooperative groups adversely influenced their learning process; students in these groups were less metacognitive and their participation in the science class diminished. The effect of social interactions on metacomprehension instruction in reading comprehension classroom remains an underexplored area in the presented field of research.

Social Environment in Classroom Learning

Reading instruction and use of metacognitive practices in an authentic classroom environment does not occur in a social vacuum but the outcomes can be altered by social interactions between students (Lundeberg & Mohan, 2009; Otero, 1998). Peer interactions in

classroom environment were shown to be an effective instructional approach in fostering reading comprehension (Rojas-Drummond, Mazón, Littleton & Vélez, 2014; Slavin, 1977; Stevens, Slavin & Farnish, 1991). For example, reciprocal teaching used social interactions to promote reading comprehension of struggling and normal readers in classrooms across cultures (Palincsar & Brown, 1984; Reichenberg & Kent, 2014; Sporer, Brunstein & Kieschke, 2009). Furthermore, social interactions were hypothesized as a key component in the acquisition of higher order thinking, particularly metacognitive thinking (Garrison, 2003; Lin, 2001; Kuhn, 2015; Vygotsky, 1978). Specifically, social factors could explain changes in calibration among lower-performing students (Hacker, Bol, & Bahbahani, 2008). However, the underlying social dynamics, which facilitate the cognitive advancements in the reading tasks, were not sufficiently examined.

Research on the influence of social environment on individual behavior started in the 1920s (Gillies & Ashman, 2003). Initial observation conceptualized that individuals who worked in the presence of other people who wanted to attain same goals perceived themselves as psychologically interdependent (Deutsch, 1949). In the pioneering observations of social dynamics, cyclists achieved faster results when they were racing against each other as compared to cyclists who raced against a clock. In another study, children who wound their fishing reels in the presence of other children were faster than children who were fishing alone (Triplet, 1898). The research concluded that individual behavior changes when a person is exposed to the presence of others (Allport, 1924). However, the variations in which individuals can interact with each other can be very

complex; this complexity of social interactions was captured in simple terms in the theory of social interdependence (Deutsch, 1949; Johnson & Johnson, 1989; Lewin, 1939). The theory explained cooperation and competition as the two main types of individual behaviors influenced by social environment (May & Doob, 1937).

The Theory of Social Interdependence

The degree to which an individual's goal accomplishment depends on actions of other individuals is termed social interdependence (Deutsch, 1949). In the social environment, the degree of social interdependence determines the type and frequency of social interactions (Johnson & Johnson, 1989). Many learning theories about reading, such as information processing theories (LaBerge & Samuels, 1974) or behaviorists learning theories (Marholin & Steinman, 1977; Thorndike, 1917) consider social interactions (individual interactions) as a random social activity unrelated to individual's goals. These conditions are characteristic of a low social interdependence where individuals display minimal social interactions due to their unrelated goals and social interactions. On the contrary, students who have high social interdependence commonly engage in social interactions that are purposeful and relate to their current goal. The theory of social interdependence provides a way to categorize these interactions into three simple groups: cooperative, competitive, and individual social interactions.

Social interdependence can be determined by considering two dimensions. The degree (*high/ low*) of interdependence and the valence of the (*positive/ negative*) interdependence are the key part of the social interdependence theory (as seen in Figure 2.2). Valence of the

social interdependence matters the most when the social interdependence is high and student's perceived that their goals depend on actions of others. High positive interdependence refers to situations in which individuals' successful goal accomplishment is dependent on the successful goal accomplishment of another individual or group of individuals. In positively interdependent social environments, social interactions can be described as cooperative interactions. Cooperative actions have a purpose to help other individuals to be successful because their success will eventually lead to one's own success. In negative socially interdependent environments, individuals also engage in purposeful interactions with other individuals, however, one can achieve a goal only when the other individuals fail to accomplish their goals. Characteristic social interactions in negative socially interdependent environments are individuals' attempts to obstruct or hamper others' actions that lead to their goal accomplishments. Such purposeful actions lead individuals to competitive behavior.

The described social environments are important representations of human social functioning in the world. Johnson and Johnson (1989) proposed that being able to adaptively act in all three types of the described social environments might have been the evolutionary advantage of humans over other species. These three social environments are ubiquitous both in school context and in the real-life situations of every individual. Yet, these fundamentally different social environments, and their effects on individuals' learning, have not been paid much attention in the recent research on metacognitive development in reading comprehension tasks. Many educators took the varying socially interdependent environment

as a commonplace and their effects were not fully investigated. The permeating effect of social interdependence was described in a quote by Johnson and Johnson (1987)

“Social interdependence to humans is like water to fish. We are immersed in it [so much that it] can escape our notice. Because we cannot imagine its absence, we often do not consider its presence (p. 88).”

		Social Interdependence	
		Positive Valence	Negative Valence
Degree of Dependence	High	(Positive Social Interdependence) Cooperative Interactions	(Negative Social Interdependence) Competitive Interaction
	Low	(Low Social Interdependence) Individual Interactions	

Figure 2.2. Expected social interactions based on perceived social interdependence. Adapted from “Cooperation and competition: Theory and research,” by D.W. Johnson & R. T. Johnson, 1989, City, State: Interaction Book Company

Studies that Examined the Effects of Social Interdependence

The research on social interdependence began on the premise that higher interdependence increases individuals' productivity and academic achievement (Deutsch, 1949; Triplett, 1898). However, there was a controversy of what types of social interdependence promote students' achievement. While some researchers argued for superior effects of competition (Michaels, 1977), others argued for superior effects of cooperation (Miller & Hamblin, 1963; Sharan, 1980). The heated discussion abated when Johnson, Johnson, Nelson, and Skon (1981) released their thorough meta-analysis of 122 studies that examined the effects of cooperative, competitive, and individual learning on achievement. Their following study demonstrated that cooperative learning promoted higher achievement than competitive and individual learning, and these effects were consistent across disciplines (language arts, reading, mathematics, science, social studies, etc.) and age groups (from elementary school to adulthood) (Johnson, Johnson, & Maruyama, 1983).

There are some considerable limitations to these findings, however. Specifically, some important factors may change the impact of cooperative and competitive environment on learning: e.g., individuals' tendency to collaborate (Kagan, Zahn, Widaman, Schwarzwald, & Tyrrell, 1985), individual's skill level (Vrugte et al., 2015), or individual's social skills (Wentzel & Watkins, 2002). It is necessary to consider such factors in more specific learning settings and more specific learning objectives, thus the learning environment may have very different effects on simple reading skills such as word recognition as opposed to more complex reading skills, as reading comprehension. In the following part, the specific impact

of social interdependence on students' metacomprehension and related skills will be discussed.

The Effect of Competition on Metacomprehension

The individual's perceived negative social interdependence commonly results in competitive actions in learning environment. Presumably, due to the unpopularity of competition among scholars (e.g. Kohn, 1992), there was a considerably small amount of studies investigating the effects of negative social interdependence on reading comprehension and metacomprehension. Despite common beliefs that competition has negative effects on learning (Cropper, 1998; Ediger, 2001; Kohn, 1992), some evidence suggests that competition can have some benefits on learning in academic environment (Bolocofsky, 1980; Rosol, 2013). For example, reviews in game-based learning environments have shown that competition can add extra challenge and motivate individuals to perform at a higher level (Vandercruysse, Vanderwaetere, Cornillie, & Clarebout, 2013). However, this effect seems to be dependent on complexity of the task and an individual skill level; competitive settings may not be beneficial for individuals who do not have high-level skills or to those who perform complex tasks (e.g., reading comprehension) (Johnson & Johnson, 2011).

When resources are perceived as scarce and valuable, a competitive environment is promoted. Incentives can further promote competitive environment by creating more scarcity (Rich & DeVitis, 1992). Therefore, the use of incentives in educational environment can (perhaps, inadvertently) lead to increased competition.

In studies on reading comprehension, incentives were commonly found to be negatively associated with outcomes in reading comprehension (Wang & Guthrie, 2004). Some scholars (e.g. Ryan & Deci, 2000) argued that incentives undermine students' intrinsic motivation, and therefore may have a negative impact on acquisition of reading skills. However, some empirical studies on the effects of incentives on reading comprehension showed mixed results. The limitations of these studies could have been caused by confounding variables such as children's cognitive capacities or cultural context (McQuillan, 1996; Schiefele et al., 2012).

On the other hand, evidence suggests that incentives provided to students for high performance can benefit the accuracy of metacognitive judgments (Gutierrez & Schraw, 2014). Importantly, the age of children might alter the effects of incentives on their performance. For instance, fifth-graders demonstrated more accurate metacognitive judgments when promised tangible gifts for performance, but no effect of incentives on third-graders' metacognitive judgments was found (Roebbers et al., 2009). These effects could be explained by the developmental stage theory that children at the age of eleven enter the stage of formal operations characteristic by abstract thinking, therefore students can make a clearer connection between the awarded points and the tangible gifts they could trade for the points (Piaget & Inhelder, 1969).

The Effect of Cooperation on Metacomprehension

Considerable amount of evidence showed that cooperative conditions can enhance students' reading skills (Almasi, 1995; Murphy et al., 2016; Slavin et al., 2009). Cooperative

peer interactions may significantly improve both students' comprehension and their metacognitive skills (King et al., 1998). Several factors contribute to enhanced learning experience in cooperative learning environments. First, students usually provide cognitive and social support to each other. As long as students have a shared goal, they will engage in productive relationships, such as peer tutoring (Epstein, 1979; King et al., 1998). Secondly, students are more likely to experience resolved instances of sociocognitive conflict during the discussion of the text, which will benefit them in their learning and text understanding (Almasi, 1995; Piaget & Inhelder, 1969).

Although the negative effects of cooperative environment on learning were not traditionally reported, Johnson and Johnson (1989) noted that these instances could happen. These phenomena are known in social sciences, as social loafing, where either less or more skilled students leave their counterparts to complete the tasks without exerting any effort (Ingham, Levinger, Graves, & Peckham, 1974). In addition, case studies on formed cooperative learning groups illustrated the adverse influence of metacognitive instances on students' engagement and learning in science classes (Anderson et al., 2009).

Johnson and Johnson (1989) posited that cooperative learning will not have a negative impact when the essential elements of cooperation are present in the cooperative conditions, such as: a) positive interdependence, b) individual accountability, c) promotive interactions, and d) group processing. However, these principles are not always obvious to the instructors and have to be carefully implemented into instructions (Antil, Jenkins, Wayne, & Vadasy, 1998; Hitchcock, Dimino, Kurki, Wilkins, & Gersten, 2011).

Combining Competition and Cooperation

Some scholars consider competition and cooperation as two mutually exclusive conditions, and thus the negative and positive social interdependence as two opposite poles on one dimension of social interdependence (e.g. Deutsch, 1949; Kohn, 1992). This bipolar view leads to the assumption that both competition and cooperation cannot be experienced at the same time (Rich & DeVitis, 1992). Pepitone (1985) argued, however, that competition and cooperation do not have to be mutually exclusive and, in fact, they may quite frequently emerge together as one social interaction. She further explained that students might experience either diminished or enhanced interdependence on both of the two separate dimensions of social interdependence, which may result in various degrees of social interdependency among individuals.

The presence of high degrees of positive and negative social interdependence was commonly described as an intergroup competition (Slavin, 1980). Slavin (1980) described in detail in two intergroup competitive learning methods that were based on combining both cooperative and competitive elements. In particular, instructors can assign students into heterogeneous teams in which the team members compete in roundtable tournaments (referred to as Teams-Game-Tournament (TGT)) or the team members perform in multiple consecutive rounds to earn points counting towards their overall team performance, which is compared to other teams (known as Student-Team-Achievement-Division (STAD)) (Kagan, 1985). Although the intergroup competition might provide benefits of both cooperative and competitive elements in educational instruction (Tauer & Harackiewicz, 2004), the potential

effects of the intergroup competitive social environment on learning have not been clearly shown (Clark et al., 2015; Johnson & Johnson, 2011). Certainly, more empirical attention must be given to studies that would demonstrate effects of intergroup competition, especially in reading comprehension and metacognition at the upper elementary grades.

In summary, cooperative social conditions that promote positive social interdependence has a positive impact on students' acquisition of reading comprehension and metacomprehension skills (Almasi, 1995; King et al., 1998). On the other hand, the effects of negative social interdependence promoted by competitive social environment on reading comprehension skills are mixed. Some evidence suggests that incentives used as an element in implementing competitive social interactions may have a positive effect on improvement in metacognitive judgments (Schraw & Gutierrez, 2014). However, cooperative and competitive social conditions can be combined by particularly structured educational tasks. The social interactions in the intergroup competitive can capitalize on the strength of both conditions, however the empirical evidence of the effects of these conditions on reading comprehension and metacomprehension outcomes are missing.

The Current Study

The purpose of the current study was to investigate the impact of competition and cooperation on students' reading and metacomprehension skills at the upper-elementary grade classrooms. Studies that have investigated the effects of metacomprehension interventions in social contexts are limited. Similar studies have found that cooperative classroom conditions have positively influenced both comprehension and metacognitive skills (Bol et al., 2012; Kramarski & Dudai, 2009; Palincsar & Brown, 1984), however, the effects of competitive classroom conditions on students' reading and metacognition were mixed (Gutierrez & Schraw, 2014; McQuillan, 1996).

The study had three main goals. The first was to examine the effect of social interdependence on metacomprehension training. In order to test and compare the effects of the presented aspects of social interdependence, a metacomprehension training intervention was designed and implemented in four different forms of social conditions: individual, competitive, cooperative, and intergroup competitive. These four conditions were also explained by 2x2 factorial design using negative (competition) and positive social interdependence (cooperation) as two separate factors (Table 3.1.). Very little research has compared the effects of both positive and negative social interdependence, and their combination on academic achievement in the same study. The described framework of social interdependence was implemented with metacognitive instructions to assess their impact on training of metacomprehension skills (Huff & Nietfeld, 2009; Thiede et al., 2012).

The second goal of the study was to observe changes of students' reading performance over the course of the intervention and account for prior abilities and motivation of students. Little research has observed changes in metacomprehension over time (Cleary, Platten, & Nelson, 2008). Moreover, some research has suggested several other factors that impact the social effectiveness of socially interdependent environment as well as the acquisition of metacomprehension skills (Pearson, 2009). Therefore, the current study examined the development of students' metacomprehension and reading comprehension skills. The analysis tested the effect of time, as well as the effects of reading abilities and motivation in addition to the condition effects on students' metacomprehension and reading comprehension skills over the course of the intervention.

The third goal of the current study was to understand how students viewed their progress in the socially interdependent school environment that emphasized their acquisition of complex academic skills (Havnes, Christiansen, Bjørk, & Hessevaagbakkeet, 2016; Heyes, 2016). An authentic learning environment requires researchers scrutinize students' learning experience in its entirety. A wide array of personal factors can influence students' literacy intervention outcomes in classroom environments (Artelt et al., 2001; Kron-sperl et al., 2008). Although many cognitive (e.g. prior knowledge) and motivational components (e.g. confidence, interest) were identified as related to metacognitive and comprehension performance (Guthrie et al., 2012), when an attempt of the study is to capture the learning experience, the scope of the study can be hardly reduced to only certain outcome measures (Kolb, 2014). To capture the unit of analysis that cannot be clearly defined a priori, such as

learning experience, it is appropriate using qualitative research methods whereby the meaning of the unit of analysis is ascribed a posteriori through a discursive process (Creswell, 2013). Thus, the study used analyses of interview reports before and after the intervention to understand students' perceptions of the metacomprehension training.

Positioning Researcher's Worldview

The majority of the reviewed research was based on methods using quantitative data analysis, and therefore, the current study follows the inquiry of the previous research on classroom reading comprehension. However, there is a considerable limitation in using quantitative methods; it may not allow for exploring and identifying the processes that can occur during interventions (Greene, Caracelli, & Graham, 1989). This limitation might be particularly pertinent to the current study that attempts to incorporate the theory of social interdependence into the reading comprehension instructions in an authentic classroom environment.

Social conditions are multifaceted constructs, which could be influenced by a multitude of unaccounted factors (Johnson & Johnson, 1989; Pepitone, 1985). Therefore, it is vital to complement the quantitative part of the study with qualitative methods that would provide descriptions of researched environment. It is believed that this approach will improve the data description, and thereby increase the validity of the data interpretation (Johnson, Onwuegbuzie, & Turner, 2007).

The researcher's worldview is commonly tied to the methodology that researchers choose to analyze the phenomenon under investigation (Schutz, Chambless, & Decuir, 2004). However,

researchers who explicitly state their worldview can more readily reflect on their subjective bias when conducting the study and triangulate their methods and complement their outcomes. Thus, the worldview adopted in the current study can be considered as pragmatic, that is characterized by selecting the usefulness of methods for a research study based on whether it will help to solve a particular research problem, or answer a research question, as opposed to selecting the methods based on their originated paradigm. Therefore, the pragmatic worldview does not hinder the current study from applying multiple methods to triangulate the investigated constructs and mix them to improve the interpretive value of the study outcomes.

Research Questions

The current study addressed the three following research questions in order to understand the impact of social interdependence on metacomprehension training in classroom environment.

1. What are the impacts of competitive and cooperative social interactions on the effects of metacomprehension training?
2. How do prior abilities and motivation impact metacomprehension skills in socially interdependent environments over time?
3. How do students perceive metacomprehension training?

Research Question 1: What are the impacts of Cooperative and Competitive Social Interactions on the Effects of Metacomprehension Training?

Distributed classroom practice of metacomprehension promotes the accuracy of students' metacomprehension judgments when provided with feedback (Huff & Nietfeld, 2009). Previous studies suggested that the accuracy of metacognitive judgments was promoted by both group learning (Bol et al., 2012) and by incentives given for high performance characteristic in a competitive learning environment (Gutierrez & Schraw, 2014). Therefore, it can be hypothesized that students in both competitive and cooperative learning conditions will exhibit increased accuracy in their metacomprehension judgments, which in turn will lead to increased reading comprehension performance (Huff & Nietfeld, 2009; Thiede et al., 2012). Furthermore, the literature suggests that when cooperative and competitive conditions are combined the learning gains are enhanced and students exhibit either equivalent (Clark et al., 2015) or superior performance to each of the conditions alone (Tauer & Harackiewicz, 2004; Vrugte et al., 2015). Thus, it can be hypothesized that students in the intergroup competitive condition will outperform the other three intervention conditions.

Research Question 2: How Do Motivation and Prior Abilities Impact Metacomprehension in Socially Interdependent Environments Over Time?

Previous research suggests that individual factors such as prior skills and motivation affect individual's performance in socially interdependent environments (Kagan et al., 1985; Johnson & Johnson, 1989). Studies that observed the effects of positive and negative social

interdependence reported that more skilled individuals benefitted from competitive conditions (Bolocofsky, 1980), whereas less skilled individuals demonstrated increased performance in cooperative conditions (Vrugte et al., 2015). Thus, it can be hypothesized that prior comprehension skills interact with time and conditions. More specifically, students with higher comprehension skills will demonstrate increased gains in metacomprehension and reading comprehension compared to less skilled students in the competitive condition. On the other hand, less skilled students will experience increased gains in metacomprehension and reading comprehension compared to more skilled students in the cooperative condition.

Several scholars have proposed that the success of the competitive and cooperative conditions depends on students' level of motivation (Tauer & Harackiewicz, 2004; Johnson & Johnson, 1989). More specifically, text interest has been shown to predict students' reading comprehension (Artelt et al., 2001; Cain, Oakhill, & Bryant, 2004) and metacomprehension (Sousa & Oakhill, 1996). Therefore, it is predicted that text interest will be related to reading comprehension and metacomprehension as revealed through an interaction effect within social conditions. Consistent with some research studies suggesting that competitive conditions may generate extrinsic motivation as opposed to intrinsic motivation (e.g., Wang & Guthrie, 2004), it can be hypothesized that the effect of students' interest in the text will positively affect the improvement in metacomprehension and reading comprehension skills across all conditions.

Research Question 3 How Do Students Perceive Metacomprehension Training?

The current study employed interviews to investigate the verbal responses of students about their experiences in the reading tasks. In order to increase the effect of the qualitative methods to capture broad phenomena, the researcher did not have a specific expectation about the observed outcomes. However, the interviews were informed by the findings from the reviewed literature and understanding of the major factors that influence reading comprehension and metacognitive outcomes (i.e. personal, task, and contextual factors) (Pearson, 2009).

Students from each condition were sampled randomly and interviewed at the beginning and at the end of the intervention training. Students' experiences were captured through semi-structured interviews that focused on students' perceptions of themselves as readers and their changes in their verbal reports from the initial session to the last session of the metacomprehension training. The students were interviewed a) about perceptions of themselves as readers and b) about their perceptions of the intervention reading session. Students' verbal responses were open coded and the codes were grouped into larger categories. The coding helped researchers to identify the changes in students' perceptions about themselves as readers and their experiences after metacomprehension training. The emerging themes were captured and used to further extend the interpretation of the quantitative results of investigated constructs. This data provided further explanation how students' metacomprehension and reading comprehension developed over the course of the intervention.

CHAPTER THREE

Methods

Research Design

The current research study employed a mixed methods design QUAN(qual) with the quantitative aspect being central to the research design (Morse, 2003). The quantitative part of the research was addressed by 2x2 factorial quasi-experimental design (see Table 3.1). Each classroom was randomly assigned to competitive, cooperative, intergroup competitive (the combination of cooperative and competitive), and individual (absence of cooperative and competitive) conditions. Across all conditions the students practiced their accuracy of metacomprehension judgments on short expository passages over the duration of three weeks (see Huff & Nietfeld, 2009). The qualitative part of the study included semi-structured interviews focused on students' experiences during the intervention. The interviews provided further context for interpretation of the quantitative data obtained in the intervention (Barron, Pea, & Engle, 2013).

Table 3.1
2x2 Factorial design representing the four experimental conditions

	Cooperation	No Cooperation
Competition	Intergroup Competitive (IntComp) (<i>n</i> = 48)	Competitive (Comp) (<i>n</i> = 44)
No Competition	Cooperative (Comp) (<i>n</i> = 45)	Individual (Ind) (<i>n</i> = 47)

Participants

Recruitment. The objective was to recruit approximately 200 of fourth- and fifth-grade students to participate in the study. After obtaining the IRB approval, elementary schools in Central North Carolina were contacted via email and asked to participate in the present research study. The communication included brief information about the study (i.e. description and purpose of the study as well as an estimate of the duration and impact of the study) (see Appendix A).

Three public school districts and fourteen schools outside of these districts were contacted by the researcher and, of those, two schools agreed to participate in the study. A meeting was scheduled with interested school officials to provide them with details about the study and to determine the interest of fourth- and fifth-grade classroom teachers in study participation. At this meeting, interested school officials and teachers were able to review the research study materials, discuss timelines, and align them with their instructional objectives. As an incentive to participate, teachers were offered an entry into a lottery for a \$200 tablet.

In addition, those teachers who secured a participation rate of at least 80% of their students were promised a \$25 honorarium.

Eight teachers in the first school and four teachers in the second school agreed to participate in the study. However, the schools differed from each other in their classroom structure. In the first school, the fourth- ($N = 4$) and fifth-grade classrooms ($N = 4$) were similar in their sizes and teaching methods ($N \sim 24$). Teachers in the same grade had regular weekly meetings and planned their lessons together. On the other hand, fourth- and fifth-grade teachers in the second school were dissimilar; while some teachers divided their classrooms by students' literacy abilities, other teachers had classrooms with mixed abilities. Teachers did not discuss their instructional objectives regularly, and their class sizes varied.

The study was conducted in both schools; however, the results are only reported from data collection from the first school. Two reasons led to this decision. First, given the variance in classroom structures between school comparisons would lack meaning. Second, the second school had classrooms with unequal sizes, smaller classrooms sizes, and classrooms grouped by students' ability, and unequal amount of fourth- ($N = 5$) and fifth-grade classrooms ($N = 2$). These school settings did not fit the proposed 2x2 research design due to several unaccounted variables between the conditions including unequal sample sizes and unequal ability levels. Therefore, the current study will focus only on the sample and outcomes from the first school.

Sample. Four fourth- grade and four fifth-grade teachers agreed to participate in the study. Their classroom sizes varied between 22 and 26 students per teacher. Students were

recruited by their language arts teachers and were provided with information about the study both in person by the researcher and by informed consent forms sent home for parental signature. Study activities were administered to all students in participating teachers' classrooms as part of teachers' regular instruction. However, only data from students whose parents consented were analyzed.

From the original sample, nine students did not return signed parental approval for study participation and one student was absent during all study activities. This resulted in a total sample size of 184 fourth- and fifth-grade students. Students who did not provide parental consent form still participated in the intervention activities with other students; however, no data were collected from them. Approximately 44.3% of students qualified for free or reduced-priced lunch for 2014-2015 school year. Participant demographics are presented in Table 3.2.

Table 3.2.
Participant demographics

Variable	Individual	Competitive	Cooperative	Intergroup Competitive	Total
Students (<i>n</i>)	47	44	45	48	184
Teachers (<i>n</i>)	2	2	2	2	8
Grade (<i>n</i>)					
4	22	22	21	23	88
5	25	22	24	25	96
Male (%)	50.00	51.11	44.44	48.98	49.19
Race (%)					
White	52.10	44.67	64.44	63.27	57.30
Hispanic or Latino	-	2.22	2.22	4.08	2.16
Black or African American	14.58	8.89	13.33	4.08	10.27
Asian	2.08	-	2.22	-	1.08
Native American	10.42	6.67	2.22	10.20	7.57
Other	16.67	28.89	13.33	12.24	17.84
Age ^a <i>M</i> (<i>SD</i>)	10.28 (.86)	10.26 (.77)	10.19 (.77)	10.13 (.75)	10.22 (.79)
HLM ^b <i>M</i> (<i>SD</i>)					
FAS II ^c	10.17 (1.80)	10.64 (1.90)	10.36 (1.96)	10.56 (1.72)	10.43 (1.84)
Books ^d	12.17 (3.77)	13.40 (2.91)	13.39 (2.54)	13.00 (3.10)	13.16 (3.10)

Note: Demographic information was missing from 9 participants; Ind ($N = 1$), Comp ($N = 2$), Coop ($N = 1$), IntComp ($N = 2$).

^aAge in years reported by students at the pretest.

^bHome literacy environment

^cComposite score from Family Affluence Scale (FASII, Currie et al., 2008).

^dComposite score derived from items that assess students' access to books at home (Sanders et al., 2004)

Time Frame and Conditions

The study was conducted in the year 2017 from March to April. A pilot study was conducted in all participating classrooms a month prior to the beginning of the study. During the pilot study, students participated in one reading session that approximated the condition of the future intervention condition.

The North Carolina public schools follow Common Core State Standards (CCSS) that are an extended and unpacked version of widely nationally adopted Common Core Standards (NGACBP, 2012), publicly accessible online (Joslin, 2010). In the upper elementary grades in North Carolina, teachers prepare students for End-of-Grade (EOG) statewide tests that take place at the end of the third and fifth grade.

In order to align the instruction with CCSS, a set of passages that covered variety of topics within the CCSS were developed (IRCMS, Nietfeld, 2007). To implement the study into the teachers' instruction, the fourth- and fifth-grade teachers obtained a list with 60 developed passages with different topics related to the upper elementary grade curriculum. Teachers were instructed to select ten passages that would fit with the content of their instructions. These passages were used as a material for the study intervention. The passages and related questions had a similar format as the testing material in EOG tests.

In order to be able to compare the effects of conditions across the fourth- and fifth-grades, the classroom teachers were divided into two groups based on the grade level that teachers taught. Then, random assignment of teachers to one of the four experimental conditions was done for each of these two groups. Two randomly selected teachers from both fourth- and fifth-grade were assigned into each one condition: competitive (Comp), cooperative (Coop), intergroup competitive (IntComp), and individual (Ind).

Measures and Materials

Pre- and Posttest Assessments (Appendix B).

Scales and questionnaires were administered to students in the form of several randomly ordered questions composed of multiple components of their motivation. The responses were recorded on a 4-point Likert scale. The measures can be reviewed in Appendix B.

Demographics. Participants completed items asking about their, age, gender, race, family affluence, and students' access to books at home. The two latter measures were used in the following analysis as a proxy of home literacy environment (HLE) that demonstrated a large impact on students' literacy skill in the prior literature (e.g., Bergen et al., 2017). Family Affluence Scale (FAS II, Currie et al. 2008) measure family SES from the perspective of a child. The measure comprised four questions measuring material wealth of the household (e.g. *During the past 12 months, how many times did you travel away on holiday with your family?*). The reported internal reliability of FAS II has not been generally high in previous studies and was also found very low in the current study ($\alpha = .33$), however, the measure was found to be a clear indicator of wealth across 30 countries, and recognized internationally as a sound instrument to assess family SES (Currie et al. 2008; Lin, 2011).

Student's access to books at home was commonly used as a component of HLE and found to be a distinct predictor of children's reading ability (Bergen et al., 2017). Access to books at home consisted of three items (e.g. *Estimate the number books that your family has at home.*) (Sanders et al., 2004). The scale demonstrated moderate reliability ($\alpha = .65$). The

two above mentioned measures were used in the following analysis as an approximation of HLE, but kept separate from each other in the analysis as the composites of both scales, although significantly correlated, showed weak to moderate relationship ($r_{[176]} = .27; p < .01$).

Reading self-efficacy. To measure students' reading self-efficacy, modified version of the Motivation for Reading Questionnaire (MRQ) was employed (Wigfield & Guthrie, 1997). Three items from the reading efficacy section of MRQ (e.g. *I know that I will do well in reading next year.*) and seven researcher-developed items were added to the scale in order to improve reliability of the scale (e.g. *When I'm reading and a I get stuck I can figure out the problem.*). Students evaluated statements about their reading believes on a scale from 1 (*totally disagree*) to 4 (*totally agree*). The measure demonstrated sufficient reliability ($\alpha = .80$).

Achievement goal orientation (AGO). Another component of students' motivation, goal orientation, was assessed by Achievement Goals Questionnaire (AGQ, Pekrun, Elliott, & Maier 2006), a revision of original scale (Elliott & McGregor, 2001). Students responded to 12 items on scale from 1 (*totally disagree*) to 4 (*totally agree*). Four subscales of three items were measured by AGQ. Four goal indices of goal orientation were created by summing three item scores for each of the four subscales: mastery-approach (e.g. *I want to learn as much as possible from class.*), mastery- avoidance (e.g. *I worry that I may not learn all that I possibly could in class.*), performance-approach (e.g. *It is important for me to do better than other students.*), and performance-avoidance goals (e.g. *I just want to avoid doing*

poorly in class.). Internal consistency was sufficient for each dimension ($\alpha = .59$, $\alpha = .73$, $\alpha = .74$, $\alpha = .46$, in respective order).

Reading enjoyment. Students' attitudes towards reading were assessed by an 11-item scale (e.g. *I like reading at school*). Agreement with items was measured on a scale from 1 (*totally disagree*) to 4 (*totally agree*). In the original study, the Cronbach's alpha was between .69 and .84 (indicating sufficient reliability) (Smith, Smith, Gilmore, & Jameson, 2012). In the current study, the last item was removed from the scale to increase the scale reliability ($\alpha = .82$).

Preference for social interdependence. Social Interdependence Scale (SIS, Johnson & Norem-Hebeisen, 1979) was used to assess students' preferences for cooperative, competitive, or individualistic learning environments. The scale consists of 22 items which belongs to one of three subscales: preference for *cooperative* social environment (9-items) (e.g., *It is a good idea for students to help each other learn*), preference for *competitive* social environment (7 items) (e.g., *I like to do better work than other students*), and preference for *individual* social environment (5 items) (e.g., *I don't like working with other students in school*). The statements for each subscale were evaluated on a scale from 1 (*not at all true of me*) to 4 (*very true of me*). The reliability coefficients of the items in cooperative, competitive, and individualistic subscales were acceptable ($\alpha = .86$, $\alpha = .87$, $\alpha = .79$, respectively).

The three subscales of the three preferences for socially interdependent environments sometimes correlate with each other (Gocłowska et al., 2016). In the current study, no

relationship was found between cooperative and competitive preferences ($r_{[175]} = -.09, p = .24$); individualistic preferences were associated negatively with cooperative preferences ($r_{[175]} = -.47, p < .001$), and was positively related to competitive preference ($r_{[175]} = .37, p < .001$).

Metacognitive knowledge. In addition to motivational scales, students completed Jr. MAI questionnaire, which was designed to assess metacognition with children between third and ninth grades (Sperling, Howard, Miller, & Murphy 2002). Participating students rated 12 statements (e.g. *I know when I understand something.*) on a scale from 1 (*never*) to 4 (*always*). The scale demonstrated sufficient reliability ($\alpha = .72$).

Reading comprehension. Two separate tests were used to assess students' reading comprehension: Gates-MacGinitie standardized test and IRCMS reading passages. The standardized Gates-MacGinitie reading comprehension test (MacGinitie, MacGinitie, Cooter, & Curry, 1989) was administered to students prior to the intervention (Form K) and after the intervention (Form L). The test contains a vocabulary section (45 multiple-choice items) and a reading comprehension section (48 multiple-choice items). Due to time constraints during the testing, the number of items was reduced to 24 items from the first of half of the reading comprehension section in each form. The reliability was estimated at $\alpha = .78$ for the comprehension section at the pretest and $\alpha = .70$ at the posttest.

As a second reading comprehension task, students completed one expository reading passage and answered a set of multiple-choice items (IRCMS, Nietfeld, 2007). Students answered eight items assessing their reading comprehension (pretest: $\alpha = .70$; posttest: α

= .69). The format of the task was similar to the tasks assigned to students during intervention sessions with two exceptions; students did not engage in the follow-up task activity pertaining to their condition and students completed eight items instead of five items. The pretest passage topic related to hurricanes, whereas the posttest passage topic related to volcanoes. The topics of the passages were chosen from the pool of teachers' preferred reading topics and balanced in their difficulty (pretest: Flesch-Kincaid index = 7.0, posttest: Flesch-Kincaid index = 7.1) and the content of both passages was related to the curricular topic on climate.

Metacomprehension. Students' metacomprehension was measured by a confidence judgments scale following reading comprehension items both on the Gates-MacGinitie tests and on the reading passages. Students were prompted (i.e. "Mark how confident you are that your answer is correct") to make confidence judgments on an 11-points scale with 10% increments ranging between 0% (*not at all confident*) and 100% (*absolutely confident*).

Students' subjective judgments were compared to their objective performance in order to compute two metacomprehension indices, calibration and response bias (Schraw, 2009). To calculate the *calibration* index the correct/incorrect answer ('1'/'0') was subtracted from the subjective confidence judgment and its absolute value was averaged across all answered items. Values approaching zero represented high calibration accuracy, whereas values approaching one represented low calibration accuracy.

Response bias was calculated in a similar manner as calibration except for using signed values instead of absolute values. This difference is important as the index provides us

not only with the information about the magnitude of the calibration but also about the direction of the judgment. Therefore, the scores that have a positive value suggest overconfidence, whereas scores having a negative value suggest underconfidence.

Both scores were calculated for the Gates-MacGinitie tests and for the reading passages. The calibration accuracy and the response bias yielded sufficient reliability in both the pretest ($\alpha = .82$; $\alpha = .80$) and the posttest ($\alpha = .71$, $\alpha = .78$) respectively in the Gates MacGinitie test. However, the reliability of both calibration and bias was much lower for the reading passage at the pretest ($\alpha = .36$; $\alpha = .36$) and the posttest ($\alpha = .33$; $\alpha = .41$), likely due to limited number of items.

Intervention Data

Reading passages. Throughout the intervention, reading comprehension was assessed by a set of eight expository reading passages followed by confidence judgments (IRCMS, Nietfeld, 2007). The topics of the passages were selected by the agreement of reading teachers in each grade. The passages were presented to students over the eight sessions based on their difficulty calculated by the Flesch-Kincaid readability index from the easiest to the most difficult (see Table 3.3).

Reading passage scores and two metacomprehension indices were obtained in each reading session. The internal consistency of the items was calculated for the reading passage scores (α ranged between .32 and .47) and for the two metacomprehension scores (calibration: α ranged between .33 and .49; bias: α ranged between .32 and .48). The reliability

coefficients were rather low as students' metacomprehension was measured by only five confidence judgments in each session.

Table 3.3.

Overview of reading passages used in the current study

4th Grade			
Reading	Passage Title	Flesch-Kincaid	Word Count
Pretest	Hurricanes	7	412
#1 Session	Glaciers	5.4	405
#2 Session	Clouds	6.1	453
#3 Session	The Atmosphere	6.7	455
#4 Session	The Earth' Forest Biomes	6.8	461
#5 Session	Natural Resources	7.8	487
#6 Session	Air Pollution	8.4	450
#7 Session	Helen Keller	9	464
#8 Session	Rosa Parks	9.3	500
Posttest	Volcanoes	7.1	414
5th Grade			
Reading	Passage Title	Flesch-Kincaid	Word Count
Pretest	Hurricanes	7	412
#1 Session	Glaciers	5.4	405
#2 Session	Sharks	6	473
#3 Session	The Food Chain	6.3	465
#4 Session	Motion and Speed	6.8	457
#5 Session	Helen Keller	9	464
#6 Session	Rosa Parks	9.3	500
#7 Session	Inherited Traits	9.5	581
#8 Session	The Circulatory System	9.9	535
Posttest	Volcanoes	7.1	414

Text interest. In order to gauge students' passage interest in text, all reading passages were followed by four items with statements regarding the interest in the particular passage (e.g. *I thought the passage was very interesting*) (Schraw, Bruning, & Svoboda, 1995).

Students rated their agreement with the statements on a scale from 1 (*totally disagree*) to 5 (*totally agree*). The internal consistency was high for each reading session ($\alpha = .89 - .90$).

Task interdependence. At the end of each intervention session, every participating student completed a rating of five statements (e.g. *I felt like I was competing with others during the reading exercise*) that assessed students' interdependence during the task activity on a scale from 1 (*not at all agree*) to 5 (*absolutely agree*). These items were added to the reading worksheets to ensure fidelity of implementation ($\alpha = .64 - .52$).

Procedures

Student consent and identification. Students obtained consent forms from their teachers to be signed by their parents. Students who did not return signed consent forms were removed from analyses, however, all students in classrooms participated in reading sessions to maintain the integrity of the classroom. Informed consent forms also offered parents the choice to opt out from the qualitative data collection (i.e. interviews), while participating in the rest of the study. Students' data were coded with a code number and their names were stripped from the dataset after the data entry. A linkage file was kept separate from the data in a password-protected file.

Pilot test. The intervention materials were piloted in all participating classrooms. A passage containing a fiction narrative was used as the content of the passage. The format of the materials and procedure remained the same as in the actual intervention across all classrooms. The pilot test revealed a need to edit wording of few items, otherwise no other issues were observed.

Pre- and Posttest Assessments

Pretest. The pretest was divided into two waves of test and survey administration. In the first wave, students completed a paper and pencil package that contained the reading self-efficacy scale, a non-fiction reading passage relevant to their grade curriculum and a standardized Gates-MacGinitie reading comprehension and vocabulary test. Students were given 28 minutes to complete the package as a whole.

In the second wave, students completed an online survey via Qualtrics, a web-based hosted domain, within 3 to 6 days after the reading comprehension package. The survey contained items described above assessing students' demographics, reading enjoyment, achievement goals, preference for social interdependence, metacognitive awareness, and reading strategies. The survey was administered during the class time without the presence of the researcher. Students followed instructions provided on the online survey.

Posttest. The study was concluded by the posttest divided into two waves of data collection. A week after the eighth reading session, reading self-efficacy scale, the expository reading passage, and the (Form K) standardized Gates-MacGinitie Reading Comprehension were administered to students. The students had 28 minutes to complete the package.

The second wave of the data collection was administered online through Qualtrics. Again, students completed items that assessed their reading enjoyment, achievement goals, preferences to social interdependence, metacognitive awareness, and reading strategies. On average, students completed the survey within 19 minutes. The researcher was not present during the administration of the survey.

Intervention

General procedures. All students participated in eight reading sessions that required them to complete worksheets (see Appendix C) and follow procedure pertaining to their condition (Table E). Students began each reading session by having one minute to provide on a blank sheet of paper as much information as they could about the title of the passage. They could write, make bullet points, or draw their responses until one minute expired. Then, students moved to reading a passage on a given topic, which was followed by five multiple-choice items with confidence judgments. After completing their answers, students also rated their interest in the passage. Students were provided a total of 13-minutes for reading and answering all questions. Then, students transitioned into a four-minute follow-up task, which differed based on the condition. After the follow-up task, students were given one additional minute to review their answers and to rate five statements related to their perceived interdependence for that reading session. After students submitted their passages, the correct answers to the five multiple-choice questions were disclosed to students. The first session was initiated by the researcher and then supervised by the class teacher.

Condition specific procedures. Students in the *individual* condition read passages and answered the questions related to the text as described above. The importance of metacomprehension judgments was emphasized. Students were reminded that more accurate judgments led to improved comprehension of the passage. When students transitioned into the four-minute follow-up task, they were asked to complete an activity related to the content of the passage they just read (e.g. writing about their own experience, generating questions of

what they would still like to know, making a drawing). The task made students reflect on the passage and extend their understanding of the passage topic. Students completed the task independently without any interactions with their peers.

To establish the *competitive* condition, a contest for the highest performing students on the reading passages was held over the duration of the intervention. Students were informed they would earn points from the passages based on their performance in the reading session. The researcher explained to students that they could earn one hundred points both for each correct answer and for the accuracy of their judgments on the answer. Altogether, students could earn up to one thousand points for the reading passage (see explanation in Appendix D).

Students were updated on their progress in two ways. First, each individual student obtained a feedback on how many points she or he scored in the last reading session. Second, all students were provided an access to a leaderboard shared both by the class teacher and by the researcher stored in a Google drive folder. The leaderboard displayed the names of the top five scoring individuals (or more if students were tied in one position) and the amount of points from the last session. Therefore, by providing students the opportunity to review their own scores and the scores of the top performers, students could easily deduce how many points they needed to earn to become the highest achieving students in their classroom.

Furthermore, students' scores were updated for two separate contests. Students competed for the best performance on the present reading session, and also for the best overall performance across passages. The students' scores for the overall performance were

calculated as a cumulative average of the points accrued in all previous reading sessions so as not to handicap students who missed previous reading sessions.

Apart from the introduced scoring system, students followed the same procedure as the students in the individual condition. After completing the reading passage task and related items, students completed the same four-minute follow-up task activity followed by rating five interdependence items as the students in the individual condition.

In the *cooperative* condition, students completed the reading passage independently in exactly the same way as the students in the two previous conditions. However, their follow-up task was different. Students were assigned to teams assembled by the researcher based on scores from the pretest reading passage. The aim was to increase the variability within teams with regard to reading skill level. The students remained in the same teams for the duration of the entire intervention.

The teams were created by a two-step procedure. In the first step students with the highest performance and the lowest performance were seeded into the same team, then students with the second highest and second lowest performance were seeded into the same team, etc. In the second step, the pairs of students were matched with other pairs to create four member teams. To further promote variability in teams, the pairs that had the most similar scores on the pretest were matched with the pair whose scores were the farthest apart, then the pairs that had the second most similar scores were matched with the pair whose score was the second farthest apart, etc. This procedure was effective for classrooms with twenty-four students, which yielded six balanced four-member teams.

In classrooms with less than twenty-four students, students with the pretest performance that ranked in the middle of the classroom were not paired in the first step. In the second step, these students who were not paired were assigned into three-member teams whose scores were the most similar, yielding six teams per classroom. One classroom had twenty-five students, the same two-step procedure was applied, yielding six teams. One student who missed the pretest was not paired in the first step of the procedure, and assigned to the team that included students whose score was the most similar resulting in one five-member team.

After students completed their reading passages individually, they received instruction to put down their pencils, take colored pencils, and meet with their team members to complete the four-minute follow-up task. The task took the form of structured discussion, in which students discussed their understanding of the passage and reviewed their completed answers and confidence judgments. Each student was allotted exactly one-minute to lead the team discussion. Students took turns in leading the team discussions, so that each student had a minute to lead the discussion until the fourth minute expired. The order of the discussion leaders was always determined prior to the discussion task by the teacher.

The discussion leaders were informed by the worksheet instructions that the most effective strategy to lead the discussion was to ask her or his teammates questions that helped them to either compare, explain, or provide a reasoning for their understanding to the passage. Sample questions were provided on the instructions (see appendix C).

Furthermore, students were encouraged to mark on the reading worksheet whether they would modify (increase or decrease) their judgments about their previous answers (see also appendix C). However, students were not allowed to change their original answers in their worksheet, they could only suggest edits to their answers using the colored pencils, thus maintain their original answers.

In the remaining one-minute, students were asked to complete the modifications of their judgments on the worksheets and to rate the five statements on the interdependence task. Upon the submission of their worksheets the correct answers to the questions were disclosed.

The *intergroup competitive* condition was a blend between the competitive and the cooperative conditions. The contests for the top performing students and the scoring system were introduced in the similar format as in the competitive condition. However, the contests were held for student teams instead of individual students. The students were assigned to teams using the same two-step procedure previously described in the cooperative condition. The students remained in the same teams for the duration of the entire intervention. The teams engaged in the same follow-up task using the structured team discussion. Prior to the reading session, the teams checked their recent scores and the leaderboards displaying the top performing team in the last reading session and the overall leading team.

Fidelity of Implementation

The researcher administered the pilot test and the first reading intervention while the classroom teachers administered the remaining reading sessions. Teachers followed procedure scripts designed by the researcher that described the sequence of the activities

students followed during the reading session. The scripts also included the duration of the activities and the directions students needed to complete particular activities (see Appendix E). The scripts varied based on conditions. The researcher developed a schedule with the teachers that specified the dates of the reading sessions. However, teachers were free to conduct the reading session at any time of the day to help them to fit the reading sessions into their daily class plans. In addition, teachers were instructed to inform the researcher about any anticipated changes to the default procedure of the reading sessions ahead of the time, teacher were instructed to report reflected changes in the procedure due to unexpected occurrences.

Several steps were taken to ensure and measure the fidelity of the treatments implemented in classrooms. First, after each reading session teachers recorded students' attendance and completed a checklist to reflect on the session. Teachers were asked to note any issues that arose during the study for individual students and self-assess to what extent they followed the procedure (see Appendix F). Teachers' self-rated their adherence to scripts on scale from 1 (*did not follow at all*) to 7 (*followed exactly*). The overall ratings remained relatively high ($M = 6.73$ $SD = .75$). The recorded duration of the reading session varied between 20 to 31 minutes. Second, students completed statements about their perceived interdependence on their worksheets at the end of each reading session (previously described as Task Interdependence). The two items specifically describing competitive ("*I felt like I was competing during the reading exercise*") and cooperative conditions ("*I felt like I was*

cooperating during the reading exercise”) were assessed to compare students’ perceived interdependence across conditions.

Issues with fidelity implementation. Multiple difficulties with implementation of the reading sessions in classrooms occurred due to unexpected complications in classrooms. Teachers experienced a number of conflicts in their schedules and were under pressure to cover certain material, which caused them to postpone a reading session. Several issues related to scheduling, and insufficient communication between teachers and the researcher arose.

- One teacher was ill at the end of the last reading session and could not be present during the intervention. Therefore, the researcher administered the last reading session instead of the absent teacher.
- There were a few instances when teachers did not implement the reading session at the day of the scheduled reading session. In the given situation, teachers administered the reading sessions immediately the after the day of the scheduled reading session.
- All fourth-grade teachers changed the schedule of their last week of the reading session and administered all four reading sessions during the second week, instead of distributing the sessions into three reading sessions in the second week and the last session in the third week. Teachers did not contact the researcher about the scheduling change, which resulted in several inconsistencies among the intervention conditions.

- All fourth-grade classroom participants concluded the study three days sooner than the fifth-grade classrooms.
- The students in the competitive and intergroup competitive conditions in the fourth-grade classrooms were not provided access to the feedback on their performance in the second half of the intervention (6th reading session onwards).
- Furthermore, one fourth-grade teacher who was assigned to the intergroup competitive condition discontinued providing students with an access to their scores in the third reading session. The teacher explained that the increased competitive environment in the classroom led several students to quarrels and personal insults. Given that the teacher could not mediate the interpersonal conflicts among students, the teacher decided to withhold access to team scores from the third session onwards.

Qualitative data

Interviews. Qualitative data were collected throughout the duration of the intervention for short interviews (approx. 6 minutes). The interviews were administered two times during intervention: after the first session, and after the eighth (last) session of the intervention (see the interview protocols in appendix G). Five percent of students from each condition ($N = 12$, three per condition) were randomly selected for the interviews. One pre-selected student refused to be interviewed during the first interview session, therefore, this student was substituted by another student randomly drawn from the same condition. One

student absented for the second interview. A total of 23 interviews were recorded and transcribed for analysis.

CHAPTER FOUR

Results

The present study examined changes in students' reading performance and metacomprehension judgments across socially interdependent conditions. The changes in students' reading performance and metacomprehension based on the conditions along with prior ability and motivation were also investigated. Students' perceptions of their progress in the metacomprehension training were examined using qualitative data. The analytical procedure will be described for each research question separately. This section contains both descriptive statistics and analyses for the study's primary research questions.

Missing Data

Responses that were missing, illegible, or ambiguous (e.g. two marked answers) were treated as missing data in the analysis. The only exceptions to this rule were for performance data and metacomprehension judgments on the standardized reading comprehension test and the study passages. In these tests, missing, illegible, or ambiguous answers were marked as incorrect.

Preliminary Analyses

In the preliminary analyses, one-way ANOVA conducted on the pretest data showed no significant differences between conditions on any observed variables including variables related to students' demographics, motivation, and prior metacognitive knowledge.

Descriptive statistics for pre- and posttest assessments on reading comprehension, metacomprehension outcomes based on the conditions are displayed in Table 4.1.

Table 4.1.
Means and standard deviations for study variables by condition and time of testing

Variable	Condition							
	Individual		Competitive		Cooperative		Intergroup Competitive	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
Reading Performance								
Passage	5.71 (1.83)	5.64 (1.46)	5.27 (1.56)	5.44 (1.25)	5.10 (1.89)	5.45 (1.38)	5.18 (1.44)	5.33 (1.31)
Gates	14.89 (6.28)	17.51 (5.09)	13.84 (6.38)	16.93 (5.07)	12.60 (5.91)	16.25 (5.47)	13.93 (5.97)	16.60 (4.66)
Metacomprehension Calibration								
Passage	.30 (.18)	.32 (.17)	.33 (.17)	.31 (.14)	.36 (.18)	.30 (.14)	.34 (.16)	.33 (.14)
Gates	.27 (.15)	.23 (.11)	.30 (.14)	.21 (.14)	.32 (.12)	.24 (.11)	.27 (.17)	.20 (.12)
Response Bias								
Passage	.16 (.21)	.21 (.21)	.24 (.20)	.25 (.14)	.23 (.24)	.21 (.17)	.24 (.16)	.27 (.16)
Gates	.27 (.15)	.12 (.14)	.28 (.19)	.16 (.15)	.32 (.13)	.12 (.14)	.26 (.17)	.14 (.13)

Note. $N = 184$.

Fidelity Implementation

Prior to conducting analyses intervention fidelity measures were examined.

Two specific items enclosed at the end of each reading worksheet completed by students during each reading session were analyzed. Specifically, first item measured negative (i.e., *I felt like I was competing during the reading exercise*) and the second item positive perceived interdependence (i.e., *I felt like I was cooperating during the reading exercise*). For the

analysis the 8x2x2 RM-ANOVA with time as a within person variable (all eight session) and the two conditions as between-person variables was applied to compare responses on both items across all reading sessions. The Mauchly's test showed that the assumption of sphericity was violated for both items (Mauchly's $W > .17, p < .001$), therefore the values from Greenhouse-Geisser's test, which is more conservative, are reported.

In regards to perceived negative social interdependence, there was a significant between group effect in competitive condition ($F_{[1, 108]} = 4.04, p < .05, \text{partial } n^2 = .04$). The pairwise comparisons demonstrated that students reported significantly higher negative social interdependence in the competitive condition ($M = 2.18, SE = .15$) compared to non-competitive conditions ($M = 1.74, SE = .17$). No other significant effects were found.

The results for the perceived positive social interdependence demonstrated a significant time effect across conditions ($F_{[7, 763]} = 2.37, p = .04, \text{partial } n^2 = .02$). The reported positive interdependence had a decreasing trend over the reading sessions (1st session: $M = 3.28, SE = .14$; 8th session: $M = 3.07, SE = .12$). Positive interdependence was also affected with significant main effects across both competitive ($F_{[1, 109]} = 4.99, p = .03, \text{partial } n^2 = .04$) and cooperative conditions ($F_{[1, 109]} = 93.50, p < .001, \text{partial } n^2 = .46$). The pairwise comparisons demonstrated that surprisingly students in competitive conditions reported significantly higher positive interdependence ($M = 3.36, SE = .14$) compared to non-competitive conditions ($M = 2.89, SE = .16$). Pairwise comparison for the cooperative condition showed that students reported higher positive social interdependence ($M = 4.14, SE = .16$) compared to the students in non-cooperative condition ($M = 2.10, SE = .13$). There

were also significant interactions between time and competitive condition ($F_{[7, 763]} = 2.90, p = .02$, partial $n^2 = .03$), and time and cooperative conditions ($F_{[7, 763]} = 5.29, p < .001$, partial $n^2 = .06$). Unlike students in non-competitive conditions who experienced a decline in positive social interdependence from the first reading session until the last reading session, students in the competitive conditions did not experience any significantly different changes in positive interdependence across sessions. The similar trend was reported for the interaction between time and cooperative conditions. Students in non-cooperative conditions rated positive social interdependence lower as the reading sessions progressed, while students in cooperative conditions did not report significantly different positive social interdependence across reading sessions, except for sessions three and eight. In cooperative conditions, students reported significantly higher positive social interdependence compared to the eighth session. The mean values for the reported perceived positive and negative interdependence across all four groups from the first and the last reading sessions are displayed in Table 4.2.

Table 4.2
Students' perceived interdependence across reading sessions.

	<i>"I felt like I was competing during the reading exercise."</i>				<i>"I felt like I was cooperating during the reading exercise."</i>			
	Ind	Comp	Coop	Intcomp	Ind	Comp	Coop	Intcomp
1 st Session	1.89	2.22	1.86	2.36	2.62	2.48	4.03	4.26
<i>M (SD)</i>	(1.45)	(1.24)	(1.23)	(1.46)	(1.75)	(1.49)	(1.17)	(1.12)
8 th Session	1.45	2.56	1.88	1.81	1.30	2.24	4.15	4.49
<i>M (SD)</i>	(1.04)	(1.52)	(1.34)	(1.20)	(.80)	(1.63)	(1.25)	(.94)

Main Analyses Overview

Multilevel modeling (MLM) was selected to answer research questions one and two. Repeated measures performance from one student as used in the current study could be a concern because of non-independent observations, which can lead to biased estimates. MLM accounts for possible error that can be caused by the non-independence of observations (Nezlek & Zyzniewski, 1998). Furthermore, balanced data are not required; the MLM approach makes use of all available data for each student and controls for the timing of the measurement (Karney & Bradbury, 1997). Finally, MLM allows for the partitioning of sources of variability in order to explain relations that vary by clusters, such as within and between students or classrooms (Snijders & Bosker, 1994).

Research Question 1: What are the Impacts of Cooperative and Competitive Social Interactions on the Effects of Metacomprehension Training?

In order to determine the differences between conditions at the end of the study, SAS Proc Mixed in version 9.4 was selected to assess the differences in reading performance and metacomprehension outcomes. Initial analyses were conducted for each outcome variable using a fully unconditional model (Model 1) that did not include any predictors. The purpose of these analyses was to ensure that the mixed model demonstrated sufficient variability at Level 1 (within students) and at Level 2 (between students) to proceed to further analyses with multiple predictors. However, the initial models indicated sufficient variance only at a single level (Level 2) for the reading comprehension measure, and insufficient variance at both Level 1 and Level 2 for both metacomprehension indices. MLM was not appropriate to

analyze reading comprehension with variance sufficient only at Level 2. Furthermore, no statistical analyses could be conducted on the metacomprehension indices without sufficient variance.

Therefore, the variance in reading comprehension was aggregated to Level 2, and the effect of the conditions on reading outcomes was analyzed by comparing mean differences of students' performance between pretest and posttest across conditions. A 2x4 RM-ANOVA was conducted to test the effects of the conditions on reading outcomes. The time was used as a within subject factor (pretest, posttest) and the dummy coded condition environments were used as between subject factors for the competitive condition (comp, no-comp) and the cooperative condition (coop, no-coop).

In order to control for possible influences of other variables that could affect the results, at first a multiple linear regression was applied to select possible predictors of students' reading comprehension. These predictors were pooled from several measures obtained at the pretest that included: demographics (i.e. age, gender, FAS, access to books), metacognitive ability (i.e. Jr. Mai), and prior motivation (i.e. reading self-efficacy, goal orientation, reading enjoyment, preference for social interdependence).

Reading Comprehension

Reading comprehension performance was examined separately for the Reading Passage and for the Gates MacGinitie reading comprehension tests. First, the results will be presented for the performance in the Reading Passage, and then for the Gates MacGinitie Test.

Reading passage. The pretest performance was entered into the regression model to measure the change from the pretest to posttest performance. Dummy coded condition effects (competition, no competition; cooperation, no cooperation) were used to account for the differences between the conditions. Consequently, further predictors that included demographics, motivation, and metacognitive outcomes were entered into the model one after another to test which of them explained the variance in students' reading comprehension gains. The variables that did not show any significant relationships with the outcome measure were removed from the model for parsimony.

The regression model ($F_{[5,152]} = 11.62, p < .001$), with an $R^2 = .28$ showed no significant effects of conditions on reading comprehension. However, both the pretest performance, the prior reading self-efficacy, and students' socioeconomic status were found to be significantly related to students' change in their reading comprehension outcomes (see Table 4.3). Students who performed higher in the pretest also performed higher on the posttest. Students who reported higher self-efficacy prior to the beginning of the intervention were also more likely to improve their performance in reading passage from the pretest to the posttest compared to students with low reading self-efficacy. And finally, students who came from a more affluent family were more likely to demonstrate increased reading comprehension on the reading passage.

Table 4.3

Predictors of reading comprehension performance on reading passage

Variables	<i>B (SE)</i>	β
Pretest	.18 (.06)	.22**
COMP	-.23 (.19)	-.09
COOP	.04 (.19)	.01
Self-Efficacy	.12 (.02)	.40***
FAS	.11 (.05)	.14*

Note. $R^2 = .28$, * $p < .05$, ** $p < .01$, *** $p < .001$

A 2x4 RM-ANCOVA was used to examine the impact of time (pretest, posttest) and conditions (IND, COMP, COOP, INTCOMP) on student's posttest outcomes. The covariates identified by multiple linear regression as significantly related to the reading comprehension were entered as control measures for the posttest outcomes. The assumption of homogeneity of variance was not violated, shown by non-significant results from both Mauchly's, Box's M, and Levene's tests. The results of the repeated measures showed a significant effect of time ($F_{[1,152]} = 5.87, p = .02$, partial $n^2 = .04$); student's demonstrated greater performance on the posttest ($M = 5.46, SD = 1.38$) compared to the pretest in reading comprehension ($M = 5.34, SD = 1.65$). Significant findings for the effects of conditions ($F_{[3,152]} = .92, p = .44$) and the interaction terms of time and conditions were not found ($F_{[3,152]} = .63, p = .60$).

Gates MacGinitie test. A multiple linear regression was applied to identify predictors that could possibly have influenced students' change in performance from the pretest to posttest on the standardized reading comprehension test. The pretest performance and the dummy coded condition effects (competition, no competition; cooperation, no

cooperation) were entered into the regression model first, and then followed by further predictors including demographics, motivation, and metacognitive outcomes. Variables that did not reveal significant relationships were removed from the model.

The identified regression model ($F_{[6,162]} = 4.08, p < .001$), with an $R^2 = .39$ showed that there were no effects of conditions on reading comprehension performance. However, four variables were significantly related to students' performance at the standardized reading comprehension test: grade level, gender, reading self-efficacy, and performance-avoidance (see Table 4.4). Students who performed higher in the first test demonstrated better results on the posttest than students with low performance at the pretest. Fifth grade students showed more change in their reading performance than fourth grade students. Also, girls demonstrated more change in their performance than boys from pretest to posttest. Interestingly, students who scored high on performance-avoidance had more change on the standardized test compared to students who did not show high performance-avoidance.

Table 4.4

Predictors of reading comprehension performance on Gates MacGinitie test

Variables	$B (SE)$	β
Pretest	.45 (.05)	.54**
COMP	.04 (.62)	<.01
COOP	-.31 (.19)	.01
Grade	1.76 (.62)	.18**
Gender	1.33 (.63)	.13*
Performance-Avoidance	.47 (.17)	.18 **

Note. $R^2 = .39$, * $p < .05$, ** $p < .01$, *** $p < .001$

A 2x4 RM-ANCOVA was applied to test the effect of time (pretest, posttest) and the effect of conditions (IND, COMP, COOP, INTCOMP) on student's posttest outcomes on the standardized reading comprehension test. The covariates that the linear regression identified as significantly related to the reading comprehension at the posttest were entered as control measures. The assumption of homogeneity of variance was not violated, since Mauchly's, Box's M, and Levene's tests were non-significant. The final results of the repeated measures analysis of variance showed no significant findings for the effect of time ($F_{[1,162]} = .13, p = .72$), the effect of condition ($F_{[3,162]} = 1.17, p = .32$), or their interaction terms ($F_{[3,162]} = .22, p = .88$).

Research Question 2: How Do Motivation and Prior Abilities Impact

Metacomprehension in Socially Interdependent Environments Over Time?

To examine the effects of motivation and prior abilities on student's acquisition of reading comprehension and metacomprehension skills, MLM was used to account for variance between students and within students (across time). The analysis model was tested in three steps. At the first step, the model (Model 1) was tested for sufficient variance at both between and within individual level. In the second step, the time effect and the effect of both competitive and cooperative conditions were estimated in the model (Model 2) to test the condition effects over time, as well as their interactions. In the final step, students' prior ability and their motivation were added to the model (Model 3) as well as the interaction terms of motivation with both conditions and students' prior ability.

For the following analyses, a new variable *time*, representing how many days elapsed from the pretest, was added to the dataset. Since teachers sometimes assigned the intervention sessions on different days than planned, the time variable was based on the number of days elapsed from the first intervention. The number of days the count of days elapsed from the first intervention accounted for the nuances in the days when students completed the reading sessions. The students' performance outcomes were stacked by time and the following model was used to examine the changes in students' reading comprehension and metacomprehension outcomes over the duration of the study intervention:

Model 2 (Time Model)

$$\text{Level 1: } Y_{ij} = \beta_{0ij} + \beta_{1ij}(\text{Time}) + r_{ij}$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{COMP}) + \gamma_{02}(\text{COOP}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{COMP}) + \gamma_{12}(\text{COOP})$$

Model description. At Level 1, Y_{ij} represents the outcome for performance in a reading passage in (1) reading comprehension, and (2) metacomprehension, computed as (2a) calibration, and (2b) response bias, predicted for student j on time i . β_{0ij} represents the intercept of the predicted outcome. β_{1ij} represents the time effect (how many days elapsed from the pretest), and r_{ij} represents the variance in the predicted posttest outcome for time i student j .

At Level 2, the individual intercepts are the outcomes (β_{0j}). At Level 2, γ_{00} represents the predicted outcome at the day of pretest for a student in the IND condition holding time

constant, γ_{01} and γ_{02} represents condition assignment (1 = in condition, 0 = not in condition) to competitive and/or to cooperative social conditions respectively, and u_{0j} represents the variance around the mean of the performance outcome in a reading passage.

The second line at Level 2 represents slopes and intercepts that predict outcomes related to the predicted time effect (β_{1j}). γ_{10} represents the time outcome slope, or predicted change in performance at the given day elapsed from the day of pretest. The following estimates represent the interaction terms for the performance at the predicted day for the specific student: γ_{11} represents the effect of time on student assigned to competitive condition relative to the IND condition, γ_{12} represents the effect of time on student assigned to cooperative condition relative to the IND condition.

In the final model, students' *interest* assessed by students' rating of the text interest after each reading passage was entered to the model at Level 1. Students' prior *ability* assessed by students' performance in the reading passage at the pretest in the observed outcome (i.e. reading comprehension, metacomprehension), was entered in the model at Level 2. In order to account for the effects of time and interest on student specific variables, the interaction terms of time and interest on both conditions and their prior abilities were also estimated. The tested model is shown below:

Final Model (Ability and Interest Model)

$$\text{Level 1: } Y_{ij} = \beta_{0ij} + \beta_{1ij}(\text{Time}) + \beta_{2ij}(\text{Interest}) + r_{ij}$$

$$\text{Level 2: } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{COMP}) + \gamma_{02}(\text{COOP}) + \gamma_{03}(\text{Ability}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11} (\text{COMP}) + \gamma_{12} (\text{COOP}) + \gamma_{13} (\text{Ability})$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21} (\text{COMP}) + \gamma_{22} (\text{COOP}) + \gamma_{23} (\text{Ability})$$

Model description. At Level 1, Y_{ij} represents the outcome for performance in a reading passage in (1) reading comprehension, and (2) metacomprehension, computed as (2a) calibration, and (2b) response bias, predicted for student j on time i . β_{0ij} represents the intercept of the predicted outcome. β_{1ij} represents time effect (how many days elapsed from the pretest), β_{2ij} represents student's interest in the particular text passage, and r_{ij} represents the variance in the predicted posttest outcome for time i student j .

At Level 2, the individual intercepts become the outcomes (β_{0j}). Additionally, at Level 2, γ_{00} represents the predicted outcome at the day of pretest for a student in the IND condition holding constant text interest and pretest performance, γ_{01} and γ_{02} represent condition assignment (1 = in condition, 0 = not in condition) to competitive and/or to cooperative social conditions respectively as compared to the IND conditions, γ_{03ij} represents student's prior ability assessed by pretest performance, and u_{0j} represents the variance around the mean of the performance outcome in a reading passage.

The second line at Level 2 represents slopes and intercepts that predict outcomes related to the predicted time effect (β_{1j}). γ_{10} represents the time outcome slope, or predicted change in performance at the given day elapsed from the day of pretest. The following estimates represent the interaction terms for the performance at the predicted day for the specific student: γ_{11} represents the effect of time on student assigned to competitive condition

relative to the individual conditions, γ_{12} represents the effect of time on student assigned to cooperative condition relative to the individual conditions, γ_{13} represents the effect of time on student with specific prior ability,

The third line at Level 2 represents slopes and intercepts that predict outcomes pertaining to the particular student's rating of text interest (β_{2j}). γ_{20} represents the text interest slope, in other words, the predicted change in performance for marked text interest. The following estimates represent the interaction terms of the marked text interest for the specific student: γ_{21} represents the effect of interest on student assigned to competitive condition relative to the individual conditions, γ_{22} represents the effect of interest on student assigned to cooperative condition relative to the individual conditions, γ_{23} represents the effect of interest on student with specific prior ability.

To improve interpretation of the intercept the prior ability variable was grand mean centered, and the text interest was group mean centered. An unconditional model (Model 1) was first specified to calculate intra-class correlations and ensure a sufficient variance at all levels that are required to examine following models. Results of all unconditional models indicated there was sufficient variability at both levels to justify the following two-level models (see Tables 4.5–4.7). The results will be described for each of the three observed outcomes: (1) reading comprehension and (2) metacomprehension measured by two indices (2a) calibration, and (2b) response bias.

1) Reading comprehension

Sufficient variability in reading comprehension between students (18%) and within students (82%) on the consecutive performance in reading passages was estimated. In the following step, the time effect and the condition effects were included in the model (Model 2) to examine students' performance in reading comprehension over the duration of intervention within conditions. Due to the significant variance found in the model, the condition slopes were allowed to vary randomly, while the time slope and interaction term slopes were constrained. Results revealed no significant main effects for time or conditions on students' reading comprehension performance. Results also did not show a significant interaction between time and conditions. The interaction term between the time and cooperative condition suggested a potential crossover effect, nonetheless the effect did not reach the level of significance ($\gamma_{12} = 0.02$, $t = 1.91$, $p = .06$). The tested model explained 1% variance within students, however, the estimated variance between students was negative.

Student's interest in the text and prior ability were added to improve the explanatory power of the model (Final Model). Interest was added to the model at Level 1. Interest was group-mean centered in order to level out potential differences among students in their ratings of the texts. Thus, text interest ratings at each session were compared to average text interest ratings for each individual student. Prior ability was entered to the model at Level 2, and grand-mean centered. The average performance of all students' in the pretest reading passages was set to zero to improve the interpretation of the intercept value. Both the ability and condition variables, had significant variance around their slopes, and therefore their

random effects were estimated in the model. The slopes of the other variables were constrained.

Results showed that reading comprehension performance during the intervention was positively predicted by students' interest in the text ($\gamma_{20} = 0.02, t = 2.93, p < .01$) and by their performance at the pretest ($\gamma_{03} = 0.24, t = 4.46, p < .001$). No other effects were found to be significantly related to the reading comprehension performance. The model explained 63% variance between students and 3% variance within students. Table 4.5 displays results from the analysis.

Table 4.5.
Unstandardized coefficients (and standard errors) of multilevel models of condition effects on reading comprehension over time including prior ability and interest

Fixed Effects	Model 1: Uncond. model	Model 2: Time model	Final Model: Ability and Interest model
RC, β_0			
Intercept, γ_{00}	4.02 (.04)***	4.05 (.15)***	4.03 (.15)***
COMP, γ_{01}		.24 (.17)	.22 (.17)
COOP, γ_{02}		-.23 (.17)	-.20 (.17)
Ability, γ_{03}			.23 (.05)***
Time, β_1			
Intercept, γ_{10}		-.01 (.01)	> -.01 (.01)
COMP, γ_{11}		-.01 (.01)	-.01 (.01)
COOP, γ_{12}		.02 (.01)	.02 (.01)
Ability, γ_{13}			-.01 (.01)
Interest, β_2			
Intercept, γ_{20}			.05 (.02) **
COMP, γ_{21}			-.02 (.02)
COOP, γ_{22}			.01 (.02)
Ability, γ_{23}			-.01 (.01)
Random Effects			
Between students RC (τ_{00})	.19 (.03)***	.28 (.08) ***	.07 (.05) *
COMP		.16 (.01) ***	.15 (01) ***
COOP		.17 (.01) ***	.18 (.01) ***
Ability			.02 (.01) *
Within students RC (σ^2)	.90 (.04)***	.89 (.04) ***	.88 (04) ***
Model Specification			
Deviance (-2LL)	4055.3	4072.8	3845.7
Number of est. parameters	3	10	15

Note. $N = 184$, * $p < .05$, ** $p < .01$, *** $p < .001$

2) Metacomprehension performance

2a) Calibration. After finding sufficient variance in the measure of calibration both between (22%) and within students (78%), the time effect and the condition effects were included in the model (Model 2). The random effects for the condition variables were estimated, while the time slopes and interaction term slopes were constrained. Results showed no significant main effects of time or conditions on students' reading comprehension performance. Results also did not show any significant interactions between time and conditions. The negative estimated variance suggested that the model needed to be improved at both levels.

In the subsequent step, interest and reading ability were added to the model (Final Model). Interest was group-mean centered and added to the model at level 1. Prior ability was grand-mean centered and entered to the model at level 2. Both the ability and condition variables had significant variance around their slopes, and therefore their random effects were estimated in the model. The slopes of other variables were constrained.

Results showed that students' calibration accuracy was predicted by students' interest in the text ($\gamma_{20} = -0.01, t = -3.16, p < .01$). Students who found the text passage more interesting demonstrated more accurate calibration judgments. Also, students' calibration at the pretest was a predictor of higher accuracy in their calibration during the intervention ($\gamma_{03} = 0.40, t = 4.42, p < .001$). This finding was further extended by significant interaction term between pretest calibration and time ($\gamma_{13} = -.01, t = -2.19, p = .03$). Although students who were more calibrated at the pretest demonstrated significantly higher calibration at the

beginning and at the end of the intervention sessions, students who were less calibrated at the beginning significantly improved their calibration judgments during the intervention compared to the highly calibrated students at the beginning (see Figure 4.1). The model explained 3% variance between students and 3% variance within students. Results are presented in Table 4.6.

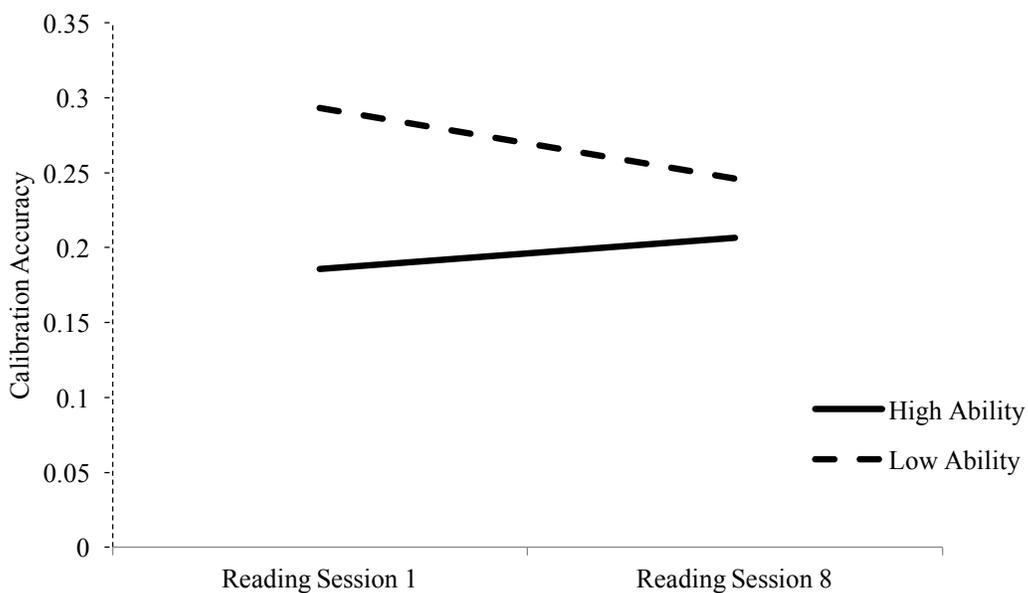


Figure 4.1.
The interaction effect of time and prior ability on calibration accuracy

Table 4.6.
Unstandardized coefficients (and standard errors) of multilevel models of condition effects on calibration over time including prior ability and interest

Fixed Effects	Model 1: Uncond. model	Model 2: Time model	Final Model: Ability and Interest model
RC, β_0			
Intercept, γ_{00}	.22 (<.01)***	.23 (.02)***	.24 (.03)***
COMP, γ_{01}		-.05 (.03)	-.06 (.03)
COOP, γ_{02}		.05 (.03)	.02 (.03)
Ability, γ_{03}			.40 (.01)***
Time, β_1			
Intercept, γ_{10}		>-.01 (<.01)	>-.01 (<.01)
COMP, γ_{11}		<.01 (<.01)	<.01 (.03)
COOP, γ_{12}		>-.01 (<.01)	>-.01 (<.01)
Ability, γ_{13}			-.01 (<.01)*
Interest, β_2			
Intercept, γ_{20}			>-.01 (<.01)**
COMP, γ_{21}			<.01 (<.01)
COOP, γ_{22}			>-.01 (<.01)
Ability, γ_{23}			>-.01 (<.01)
Random Effects			
Between students (τ_{00})	<.01(<.01)***	.01 (<.01)***	<.01 (<.01)**
COMP		<.01 (.01)***	<.01 (<.01)***
COOP		<.01 (<.01)***	<.01 (<.01)***
Within students (σ^2)	.03(<.01)***	<.01 (<.01)***	.03 (<.01)***
Model Specification			
Deviance (-2LL)	-878.0	-839.9	-824.4
Number of est. parameters	3	10	14

Note. $N = 184$, * $p < .05$, ** $p < .01$, *** $p < .001$

2b) Response bias. The unconditional model estimated sufficient variance in response bias both between (23%) and within students (77%). In the next step, the effects of time and conditions were included in the second model (Model 2). The slopes of the condition variables were allowed to vary around their mean, while the time slopes and interaction term slopes were constrained. Results did not reveal any significant effects of on students' calibration bias during the intervention. The model explained 1% of variance within students. However, the model estimated negative variance between students.

In the following step, interest and reading ability were added to the model (Final Model). Interest was entered at level 1, whereas prior ability was entered at level 2. Both the ability and condition variables displayed significant variance around their slopes, and their random effects were estimated. The slopes were constrained for other variables.

Results showed that students' response bias was predicted by their prior ability ($\gamma_{03} = 0.49, t = 5.78, p < .001$). In other words, the response bias students demonstrated at the pretest predicted to large extent students' bias in their subsequent reading passages. Furthermore, there was a crossover effect of prior response and time ($\gamma_{13} = -.01, t = 2.64, p < .01$). Students who had greater bias before the intervention study manifested significantly higher response bias both at the beginning and towards the end of the intervention study compared to the students who manifested lower bias. However, students with greater bias also significantly reduced their bias over the duration of the study as opposed to students with low initial bias (see Figure 4.2). The model explained 68% variance between students and 2% variance within students. Results are presented in Table 4.7.

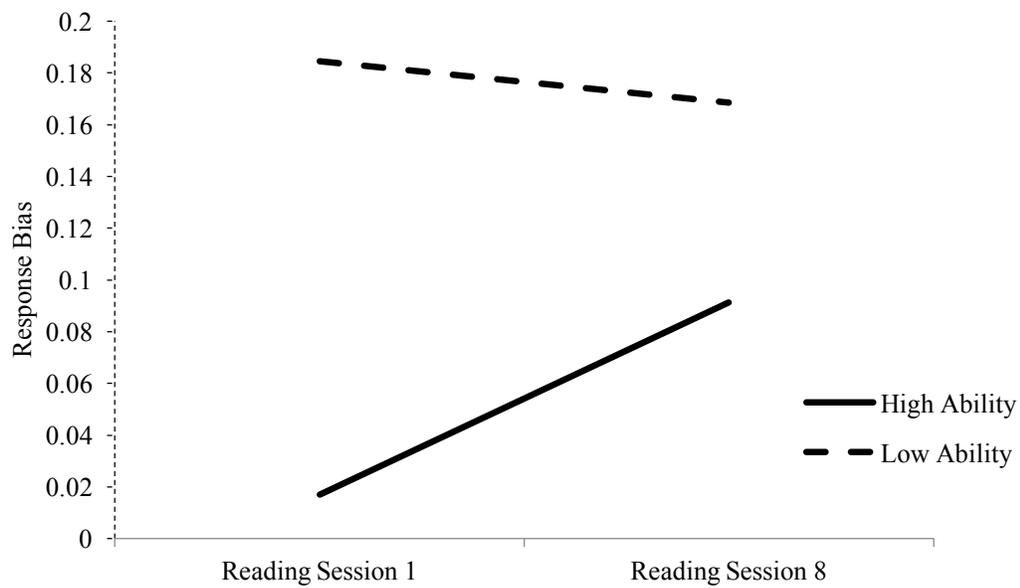


Figure 4.2.

The interaction effect of time and prior ability on calibration accuracy

Table 4.7.
Unstandardized coefficients (and standard errors) of multilevel models of condition effects on response bias over time including prior ability and interest

Fixed Effects	Model 1: Uncond. model	Model 2: Time model	Final Model: Ability and Interest model
RC, β_0			
Intercept, γ_{00}	.11 (<.01)***	.08 (.03)***	.09 (.03)***
COMP, γ_{01}		-.02 (.03)	-.03 (.03)
COOP, γ_{02}		-.05 (.03)	-.01 (.03)
Ability, γ_{03}			.49 (.08)***
Time, β_1			
Intercept, γ_{10}		.08 (.03)	<.01 (<.01)
COMP, γ_{11}		<.01 (<.01)	<.01 (<.01)
COOP, γ_{12}		>-.01 (<.01)	>-.01 (<.01)
Ability, γ_{13}			-.01 (<.01)*
Interest, β_2			
Intercept, γ_{20}			>-.01 (<.01)
COMP, γ_{21}			<.01 (<.01)
COOP, γ_{22}			>-.01 (<.01)
Ability, γ_{23}			>-.01 (<.01)
Random Effects			
Between students (τ_{00})	.01 (<.01)***	.01 (<.01)***	<.01 (<.01)**
COMP		<.01 (<.01)***	<.01 (<.01)***
COOP		<.01 (<.01)***	<.01 (<.01)***
Ability			.10 (<.01)***
Within students (σ^2)	.03 (<.01)***	.03 (<.01)***	.03 (<.01)***
Model Specification			
Deviance (-2LL)	-514.1	-491.0	-519.3
Number of est. parameters	3	10	15

Note. $N = 184$, * $p < .05$, ** $p < .01$, *** $p < .001$

Research Question 3: How Do Students Perceive Metacomprehension Training?

Two coders (the researcher and a graduate student) analyzed a portion of the interviews to find common themes in students' self-reported experiences from the intervention. In the initial meeting the coders analyzed interviews from two participants together and captured the emerging themes. Three major categories occurred in this initial phase: Metacognition, Motivation, and Task Experiences. These three categories led to the creation of a coding scheme used for the subsequent data analysis sessions. The initial coding scheme was refined by adding several subcategories in following coding sessions. In the next four coding sessions, coders analyzed data from interviewees separately and met to compare and discuss their codes. The coders calculated inter-rater agreement between their codes (identical codes / the number of all assigned codes). The conflicts in the codes were discussed and resolved to complete agreement. Both coders applied codes on all interviews. They progressively improved their level of agreement through the sessions (1st session: 52%, 2nd session: 77%, 3rd session: 85%, 4th session: 84%). The coding scheme was reviewed and finalized by both coders (Table 4.8).

Validation strategies. In order to enhance the credibility of the qualitative component of the research, several validation strategies were applied (Cresswell, 2013). The researcher used memoing, writing down ideas and notes that occurred during the coding process, which elucidated the emergence of several themes. Peer debriefing was used throughout the entire qualitative analysis. The researcher discussed the data with a peer that challenged the researcher in regards to methods, interpretations, and broadening the data

beyond the context. The researcher was also aware of personal bias that could affect the process and outcomes on the qualitative analysis. The researcher has explicitly stated his bias before the study.

Researchers' bias. The structure and the interpretation of the interviews were influenced by researchers' knowledge and experience. Both the researcher and the second coder were ESL speakers and had experience with children and teachers in K-5 environment from European cultural environment. Therefore, a possible cultural barrier might have been present in both data collection and the analysis. All subjects who were interviewed knew that the researcher was affiliated with the intervention study. Therefore, the verbal reports of the subjects might have been influenced by unintended expectations of the researcher. Lastly, the second coder was also ESL speaker with an educational experience from Southeast Asian cultural environment. Therefore, the data coding and interpretation could have been affected by the differences in the cultural backgrounds.

Table 4.8

Coding scheme applied to analyze interview data

Category	Subcategory	Description	Example
Metacognition	Knowledge	Students' understanding why she or he is a good/bad reader.	<i>"Because I am on a seventh grade reading level and I enjoy reading."</i>
		Students' understanding what can help her or him to become a better reader.	<i>"Get better books that are more my level."</i>
	Strategies	Description of strategies that help students with text comprehension.	<i>"I noticed that I did better whenever I read the questions first then I read the article."</i>

Table 4.8 Continued

	Monitoring Practices	
	Student's description of cues that help her or him to realize that the comprehension is breaking down.	<i>"It'll pop up in my head kind of, and then it'll just sit there in my head and I can visualize it and see it, and I know what it's talking about. But if I don't then it's kind of like a blur to me."</i>
	Description of reading behavior that help student to find a main idea in the text.	<i>"Once I read the whole entire text or story, I can figure out what it's mainly about and I can find things to support it."</i>
Motivation	Confidence	
	Student's expresses confidence in her or his reading comprehension skills	<i>"I can comprehend good."</i>
	Enjoyment	
	Student describes whether he or she enjoys reading.	<i>"Ever since I was little, I always loved to read and write."</i>
	Reading with others	
	Student describes whether she or he prefers reading alone or reading with someone else.	<i>"Read with someone else. Cause I usually like someone to help me out, like if I ever don't know how to pronounce a word I would need some help."</i>
Task Experience	Overall	
	Student's attitudes towards the reading session.	<i>"It helped me to get better."</i>
	Specific Parts	
	Student mentions a specific part of the reading session and her or his attitudes towards this part.	<i>"I liked whenever we talked about our answers and figured out how we got 'em."</i>

Task Experiences

Students' experiences and perceptions about the tasks were divided into their general expressions about the task and comments on specific parts of the tasks.

Overall task experiences. Most interviewed students (74%) reported that they enjoyed the reading sessions. One student said, "It was fun." Another student's answer to the question of how he liked the task, "Pretty good." However, several students reported much less enthusiasm in the task "It wasn't that interesting" or "Mainly since I had to read it made me bored." It was apparent that the students who reported their positive experiences from the reading sessions made these comments more frequently when they were interviewed after the last intervention (80%) compared to the first interview (67%).

Specific task experiences. Students highlighted various parts of the reading sessions as the reasons when they liked or disliked the reading sessions. Generally, the majority of students (75%) commented on the content of the readings. Most students liked the reading sessions because they learned some new piece of knowledge, "I liked it 'cause I learned a lotta new things, like I didn't know that you had 60,000 miles of blood vessels." or because the content of the passages matched with their personal interest. "Just reading about glaciers 'cause it's something I'm interested in.;" "I liked how they did a biography about a real person, and how I get to know her [Rosa Parks'] life story." On the other hand, the reading content did not always match with students' interest. One student illustrated this fact in her comment, "Sometimes when I read, if I don't wanna read something, then it doesn't really interest me." She added "I just don't like glaciers." Several students from the COOP and

INTCOMP also mentioned that they liked the teamwork and the practice of making judgments. Most commonly, students who commented on the team work also mentioned that they liked the reading sessions because of the team work, “I liked the way we do the ... how confident we think, and when we do the team discussion. Yeah.” No student from the COMP or INTCOMP groups commented on the competitive elements of the reading sessions (e.g. reading scores).

Metacognition

Interviews also captured instances when students’ demonstrated their metacognition. The instances of metacognition were categorized into knowledge, strategies, and monitoring practices.

Metacognitive knowledge. Metacognitive knowledge occurred mainly when students were asked to explain 1) what made them believe that they were good or bad readers and 2) how they could improve their reading skills in the future. This did not happen as frequently because students most commonly (67%) attributed their reading abilities to their grades or comparison tests, “I always get good grades in ELA [English Language Arts] and I always get good grades on my reading EoG [End-of-Grade], so I think I’m a really good reader.” A budding metacognitive knowledge was shown in this student who recognized her strengths and weaknesses in reading, “I’m a pretty good reader when it comes down to some things, but sometimes it’s kind of hard.” Furthermore, few students (33%) assessed their abilities based on their experiences with the text. One student specifically referred to useful reading strategies as a measure of her reading abilities, “[I am a good reader] because recently over

the years, I've learned new techniques on how to do things or how to redo things and make sure that ...[I] look back in the text and just make sure I know how to pronounce things ... ”

Reading strategies. All students were able to generate a reading strategy that they would use if they encountered a difficult part of the text. The knowledge about strategies varied among students. Students named strategies such as “looking for context clues”, “sounding out words”, or “finding main idea.” Compared to the first interview, students in the second interview were more likely to provide a more specific reading strategy pertaining to testing conditions: ”I noticed that I do better whenever I read the questions first then I read the article” or “.. I go back in the text ..”

Monitoring practices. When students were asked about their reading monitoring practices, there was usually a longer pause before they answered. When students described how they knew whether they understood what they read, most students referred to their struggle to pronounce a word (42%) and/or align the information with the main idea of the text (92%), “I notice I keep trying to say the word and try to figure out what it is.” A few students (25%) emphasized the coherence of their mental images about the text, “I know that when I don't understand what I read is when I know what I read. If I read some pages, I can know how ... I can picture it. But when I come to a sentence that I don't really know, I cannot picture it.” Only one student mentioned that his recognition of text incomprehension is informed by some external source, such as receiving an evaluation of an answer “When I answer questions, and I won't get them right.”

Motivation

Motivation emerged in the interview data as one of the major themes related to students' experiences in reading session and their metacognition. The students' responses were categorized to the comments related to their reading confidence, reading enjoyment, and their preferences to read alone or with somebody else.

Confidence. A majority of students (75%) mentioned they were good readers and confident in their reading abilities. All students expressed their confidence that they can improve their reading abilities either by “reading more” (71%) and by “using more reading strategies” (36%) all students also believed after the first reading session they would “get better” in the following reading sessions.

Enjoyment. Students associated reading with enjoyment (67%), among them some of them mentioned they enjoyed reading despite some difficulties, “Ever since I was little, I always loved to read and write, but sometimes I have trouble with comprehension.” On the other hand, two students also recognized their joy of reading as a sign of good readers. Interviewer: “Why do you think you are a good reader?” Student: “I like to read books.” However, students (58%) also admitted that their reading interest sometimes depends on the topic of the text. “I liked the reading task, it’s just I don’t like non-fiction books, I meant texts.”

Preference to read alone or with someone else. When asked whether students liked reading alone or with someone else, students displayed their preferences for both options. However, in the first reading session, students mentioned more frequently they would prefer reading alone (67%) compared to students who preferred reading with someone else (25%),

whereas students' preferences for reading alone were mentioned less frequently at the end of the intervention (33%), while preferences for reading with someone else were a little higher (42%). Some students mentioned the preference and merits of reading alone and with someone else at the same time, "I'm in the middle because I like reading with someone because if I don't understand something, they might help me or there might be something that I can explain to them or they can explain to them or they can explain to me. And then when I read alone, I like it because it's quite and I can probably understand things more."

Changes in Students' Perceptions

Overall, all students evaluated the reading sessions positively and they found some merit in the reading practice provided by the reading sessions. A majority of the changes in students' self-reported verbal reports were related to their confidence and to their metacognitive knowledge.

Changes in confidence. Three students (27%) provided very specific examples of how the intervention helped them in their reading, "I read better. And I can show I know better than I used to." For several students, comments on the contribution of the reading practice to their reading were related to their confidence as expressed by one student, "I realized that I can read quickly, ...[prompt from an interviewer] because I was finished before everybody else." and also another student, "It made me feel like I understand a bit more."

Changes in metacognitive knowledge. When comparing differences between students' comments at the initial session and after the final session, three students (36%)

made references that showed their shifts in their metacognitive knowledge regarding reading as a process, “The more I read passages the better I get at them.” and “When I look back at the text, it makes me feel more right it feels more correct.” Many students had a chance to learn something about themselves as readers, "I've learned that I could be a really good reader, or sometimes I could be a bad reader because sometimes I can mispronounce words a lot and then I might skip over something. And then when I get to the questions it's part that I skipped over, so sometimes I think I'm good and bad." Students also realized that they have particular ‘tastes’ for readings “I learned that I am like ... How do I say this, very picky.” The expected benefit of the entire intervention aligned with the researcher’s purpose of the study was formulated in one of the student’s words, “It shows me how much I could do and about how much I could probably improve.”

CHAPTER FIVE

Discussion

Students require strong metacognitive skills in order to monitor their reading comprehension and actively intervene when their reading comprehension is breaking down (Greasser, 2007; Maki & Berry, 1998). Repeated practice in comprehension judgments can enhance students' metacomprehension skills and improve their reading comprehension (Huff & Nietfeld, 2009). Increased social interdependence, the perception that one's own success depends on actions of others, can facilitate the acquisition of metacognitive skills (Johnson & Johnson, 1989; King et al., 1998; Kuhn, 2015). The current study examined the effects of two socially interdependent environments, cooperative and competitive, on the development of metacomprehension and reading comprehension skills in fourth- and fifth-grade classrooms. Students practiced metacomprehension judgments on short reading passages in eight sessions distributed into three weeks. Students were assigned to four conditions varying in social interdependence: cooperative, competitive, intergroup competitive, and individual conditions. The effects of the intervention were assessed by two pre- and posttest assessments: a researcher developed reading passage and the Gates MacGinitie standardized reading comprehension test. Furthermore, students' development of their metacomprehension and reading comprehension skills on the reading passages were analyzed while controlling for prior abilities and motivation. Repeated interviews with several randomly selected students both at the beginning and at the end of the intervention extended the interpretation of the study outcomes.

Findings Overview

The current study did not find clear evidence that socially interdependent conditions had an impact on metacomprehension or reading comprehension. More specifically, the analyses of the effects of competitive and cooperative conditions on reading comprehension assessed on both reading passages and a standardized reading comprehension test did not show statistically significant differences between conditions. The lack of findings could be interpreted that the socially interdependent classroom environment did not have any effect on students' metacomprehension and reading comprehension. However, this conclusion would be in conflict with large body of the literature arguing that a high level of social interdependence results in higher academic achievement (Johnson & Johnson, 1989), improved performance in metacognitive skills (Bol et al., 2012; King et al., 1998), and reading comprehension skills (Stevens, Slavin, & Farnish, 1991). Therefore, it may be more plausible to assume that the designed social interdependent conditions were not potent enough to affect students' reading comprehension or that the social conditions did not impact the acquisition of metacomprehension skills directly as tested in the current study.

The current study applied a framework of social interdependence (Deutsch, 1949; Johnson & Johnson, 1989), which generalized the social environment into four conditions: cooperation, competition, intergroup competition, and individual conditions. However, this perspective is only one approach to study the effects of social context in an academic environment. Previous studies that showed positive outcomes of applied social context on development of complex thinking in classroom environment were more focused on the group

work (Bol et al., 2012; Meloth & Deering, 1994) or specific interactions among peers (Almasi, 1995; King et al., 1998). Therefore, it is possible that the framework of the social interdependence theory can be too broad to identify the potent aspects of effective classroom practice.

The metacomprehension training in the present study significantly improved students' reading comprehension performance measured by reading passages. However, these findings are not directly attributable to the training in the absence of a control condition, hence testing the effectiveness of the training itself was not the aim of the current study. On the other hand, the results provide support to the utility of the applied format for metacomprehension training (Huff & Nietfeld, 2009). Nevertheless, the current study did not find a significant improvement on the standardized reading comprehension measured by the Gates MacGinitie test. Yet this was in line with previous studies that reported improvements of reading comprehension only on researcher-designed tasks but not on standardized tests (Malone & Mastropieri, 1992; Schunk & Rice, 1992).

Results of the current study identified several significant relationships between personal student characteristics and posttest performance in reading comprehension. In particular, demographic measures (i.e. family affluence, gender, and grade level), motivation (i.e. self-efficacy and goal orientation), and pretest performance were related to reading comprehension at the posttest. First, the current study showed that an indicator of students' family affluence (FAS II, Currie et al., 2008) predicted students' performance on the reading passage posttest, but not on the standardized test. This corresponds to findings from prior

studies on literacy level across nearly 30 countries, in which family affluence contributed to higher children's literacy (Currie et al., 2008; Lin, 2010). Second, the current results also correspond with previously reported gender differences in reading comprehension among upper-elementary grade children showing that girls commonly perform better on standardized reading comprehension tests than boys (Logan & Johnston, 2009; Vilenius-Tuohimaa, Aunola, & Nurmi, 2009). Furthermore, as found in the previous research studies, reading self-efficacy was positively correlated to students' outcomes in the posttest reading passage (Guthrie et al., 2012). Finally, the current results showed that subcomponent of goal orientation, performance avoidance, was a positive predictor of students' reading comprehension assessed by standardized reading comprehension test. This finding was rather surprising, as previous studies traditionally linked performance-avoidance with test anxiety and maladaptive task strategies (Elliott & McGregor, 2001; Skaalvik, 1997). On the other hand, some evidence has suggested that performance-avoidance could be an adaptive motivational component in learning environment in collectivistic social environments (King, 2016). On the other, it must be noted that the measure reliability was suboptimal and the results need to be replicated by further research.

The second research question explored the development of students' reading comprehension and metacomprehension skills in established socially interdependent conditions over time. No significant effects of either competitive or cooperative social conditions on the observed reading comprehension and metacomprehension skills were found. Non-significant effects of the conditions were also found for the interaction effects between

conditions and time, conditions and prior abilities, and conditions and students' interest in text. Similarly, as previously described, the findings may likely be attributed to the lack of potency of the established socially interdependent environments on student's reading comprehension and metacomprehension. The inconsistency of the current findings with the prior literature might be explained through different perspective on the competitive and cooperative interactions between the current study that applied the framework of social interdependence (Johnson & Johnson, 1989) and the reviewed studies (Bol et al., 2012; Slavin, 2013; Vrugte et al. 2015). Perhaps the key elements of social interactions that contribute to students' performance do not occur within these conditions automatically and needs to be practiced. For instance, if students in the cooperative groups had higher social skills, a larger effect of the cooperative conditions on the observed outcomes would be seen (Wentzel & Watkins, 2002).

This hypothesis has some support in the current data. The MLM showed significant random effects for both condition variables, suggesting a large unexplained variance around the estimated slope of the observed condition variables (Bryk & Raudenbush, 2002). Furthermore, the fidelity implementation check revealed that, although the manipulated conditions increased both positive and negative social interdependence among students, the conditions were contaminated by a spillover effect. Students in all conditions reported decrease in positive social interdependence, but both the competitive and cooperative conditions maintained higher positive social interdependence compared to other groups.

Noteworthy, the current study did not find a negative effect of the competitive

condition on students' reading comprehension or metacomprehension performance. This finding brings evidence that contrasts with arguments against implementing competitive classroom environment to promote learning of complex cognitive skills (e.g., Kohn, 1992; Ryan & Deci, 2000). Although the current study did not find the competitive conditions as being superior to other conditions, the results demonstrated that competition had effects that were comparable to other formats of instructions on acquisition of reading comprehension and metacomprehension. However, these findings could have been limited by the complications with implementing the intergroup competitive classroom environment.

The current study extended the findings of the effectiveness of the metacomprehension training in several ways. First, the current study found that prior abilities have a positive impact on both reading comprehension and metacomprehension as measured by calibration and response bias. Furthermore, this study found that students with low prior metacognitive abilities significantly increased accuracy and reduced bias of their metacomprehension judgments over time as compared to students with high abilities. These outcomes are consistent with the literature, positing that implementing metacognitive interventions into classrooms might be more impactful on students with lower level abilities (White & Frederiksen, 1998; Zohar & David, 2008). However, these findings can be also interpreted by a 'ceiling effect.' The testing conditions might not have provided students with opportunity to manifest their improvement in judgment accuracy, simply because they were already accurate. Further research would need to address these differences in students' abilities.

Second, text interest showed a consistent association with reading performance and metacomprehension assessed by the calibration index across the intervention. The finding has corroborated on the bulk of literature that showed interest as a motivational construct related to the deeper understanding and higher engagement in complex reading tasks (Schiefele, 1996; Schiefele et al., 2012).

No effect of time was found over the duration of the intervention, despite students' improvement in their reading comprehension performance in the standardized reading test. However, a positive time effect on students' performance were not expected in the current study, hence the students were presented with progressively more difficult texts during each reading session. Therefore, the potential increased performance in comprehension and metacomprehension would be diminished by the increase in text difficulty. Since the study did not show a significant decline in students' performance on the observed measures over the course of the intervention, and students' performance was relatively steady despite the increasing difficulty of the presented passages, one could posit that overall students improved both their reading comprehension and metacomprehension skills.

It must be noted that the qualitative component of the current study provided evidence that some changes in students reading behavior based on the assigned conditions were apparent. Specifically, students who participated in the cooperative conditions were more likely to report that they enjoyed learning about topics from reading passages through team discussions and by making confidence judgments than in the non-cooperative conditions. Students from the cooperative conditions also frequently reported that they would

seek help from their peers if they encountered difficulties to comprehend text. Although these findings are embedded in the context of the intervention and cannot be generalized, they provide some evidence the implemented conditions had a positive learning influence on students.

Furthermore, apart from the expected theme of metacognition, motivation also emerged in the qualitative data as one of the main themes that affected readers' approach to the reading passages. Both confidence and interest were mentioned as reasons for why students engaged in reading, and how they approached future reading tasks. Apart from the task engagement, when students were prompted further to describe their reading process, more explicit links between the motivation and metacognition became apparent. Specifically, when students were asked to provide sources of their confidence, some students revealed that their confidence was based on their metacognitive knowledge, such as knowing several reading strategies, or ability to recognize one's own weaknesses. Even though many students expressed high confidence in their reading abilities both at the beginning and at the end of the intervention session, their reasoning for their higher confidence changed, more specifically, particular students were more likely to report metacognitive skills as the reason for their confidence in reading.

The connection between metacognition and motivation also emerged for the text interest. In the student interviews, preferences of different text genres and topics varied across students. One student realized she had a very specific 'taste' for which text she found interesting. However, after the last reading session, several students reported that they

recognized that interesting texts helped them understand the text better. Students were more likely to say that the choice of the future text may help them improve their reading skills.

The majority of students subjectively reported that their skills improved over the course of the intervention. At the beginning of the intervention, students mentioned that they could improve their reading skills through repeated practice. The intervention aligned with their vision. Students reported that the reading practice did help them develop their reading skills. Most of the students also identified that the reading sessions were unique in comparison to their regular classroom activities. Students reported that the metacomprehension training was very valuable reading practice and helped to become more confident and skillful readers.

In summary, the current study did not provide sufficient evidence that socially interdependent environments promote reading comprehension and metacomprehension skills. No effects of the socially interdependent conditions were found on any observed outcomes. While some evidence of the gains in reading comprehension was reported at the conclusion of the study, these results were diminished by the absence of a true control condition. The condition effects on metacomprehension outcomes at the end of the study have not been analyzed because of low variance in the collected data. Prior ability and motivation were found as strong predictors of reading comprehension and metacomprehension. Analysis of verbal reports elaborated on the observed relationships between motivation and metacognition and provided an insight into students' naïve knowledge about the effects of these two components on their reading skills.

Limitations of the Current Study

Several methodological issues may have limited the findings reported in the current study. The major limitation was the fidelity of implementation. Despite many preventive measures, several challenges were present during study implementation. Teachers had a difficulty to follow the designed schedule and an insufficient communication led some teachers to change the procedure without notifying the researcher. These results could have weakened the overall effect of the study. Despite scripted protocol and homogenized learning environment in the current intervention, another possible limitation could have been the lack of measure that would control the efficiency of teachers' instruction on students, which could have contributed to some unexplained variance in the data across conditions.

Unexpectedly, the analysis of students' perceived interdependence did not show there was a clear distinction between the desired perception of the socially interdependent environment. Particularly, students in the competitive condition displayed they experienced somewhat increased positive social interdependence. This insufficient discrepancy could have been caused by the teacher effect who might have discouraged students from over competitive interactions. Specifically, some teachers in the competitive classrooms were not consistent in providing feedback to students and in one classroom a teacher intervened in the growing competitiveness among students at the beginning of the intervention. These inadvertent teachers' interventions could have diminished potency of the research conditions. Presented observation invites future researchers to inspect more closely the design and conduct of competitive and cooperative classroom and their impact on students' perceived

interdependence and subsequent learning outcomes.

An unexpected methodological limitation of the study was the low variance found in the pre- and posttest measures of metacomprehension. Although metacognitive judgments were repeatedly used and markedly improved over the last decades in the bulk of previous studies (Huff & Nietfeld, 2009; Schraw, 2009a), the outcome variance among students was insufficient for intended analytical methods. Several instruments demonstrated decreased reliability during the intervention due to small number of items, therefore some intervention instruments could be considered for revisions in the future.

The sample obtained from a single school was also a limiting factor, which could have contributed to the lack of obtained findings. The school was located in rural area, where population tends to be more homogenous as showed in the current study. The homogenous population could have led to lower variance obtained in the observed sample, which is one of the condition for desired effects of socially interdependent environment (Kagan, 1985). Furthermore, the future studies should consider employing robust measured of home literacy environment as they could help controlling for students' potential to acquire literacy skills and enable researchers to relate their findings from their researched samples to the relevant class of population.

Future Directions

The limitations of the current study suggest that future research can further improve the techniques to establish and maintain positive and negative social interdependence in

classrooms. Although there are many theoretical guidelines to promote social interdependence in classrooms (Johnson & Johnson, 1998; Slavin, 1985), the effectiveness of these methods was compared only by students' achievement outcomes (Johnson & Johnson, 2000). However, future studies should also collect both students and teachers' perceptions of the implemented socially interdependent classroom environment and develop a reliable assessment to check the validity of their implementation in classrooms. Furthermore, it must be emphasized that teachers play a significant role in promoting the social interdependent environment (Antil et al., 1998), therefore, future research can also focus on promoting teachers' skills to incorporate socially interdependent environment in their classrooms effectively.

The investigation of the effect of designed conditions on metacomprehension intervention applied in the current study was based on the theory of social interdependence (Johnson & Johnson, 1989). However, the large amount of unexplained variance within the classrooms points to the fact the utilized framework could have been too broad and that there could be a large potential in focusing empirical attention on more specific social interactions between students during the intervention. It is possible that engagement in specific interactions between students (e.g. constructive argumentation, discourse conversation) may have more pronounced effects on performance outcomes in intervention studies that promote academic skills.

Furthermore, prior research showed that students require extended practice in metacognitive monitoring judgments followed by corrective feedback (Nietfeld, Cao, &

Osborne, 2006). Future studies can examine the form and frequency of the feedback provided to students for their accuracy and bias in their judgments. In addition to this, Baker and Beall (2009) argued that reading instructions based on metacognitive thinking should be intended to help students make their knowledge more explicit. Therefore, future research can also assess how students' explicit knowledge, in addition to monitoring training, impact students' development of metacomprehension skills.

The current study revealed that prior ability and motivation may alter acquisition of metacomprehension by both quantitative and qualitative analysis. The interactions between metacognition, ability, and motivation should be investigated further. Students' understanding between the connections of their motivation and their thinking skills could also shed light on effective classroom practices promoting complex cognitive skills, such as reading comprehension. The future studies should continue to use multi-method approach to triangulate findings and further advance the methodological practices in educational research.

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APPENDICES

Appendix A. - Email to Teachers and Principals

Subject: Reading Comprehension Research

Dear ____.

My name is Ondrej Pesout, I am a PhD student at NC State and I work with Dr. Nietfeld on developing reading comprehension classroom instructions. We are building upon a previous classroom-based comprehension program (IRCMS) to further promote the current reading comprehension instruction for four- and fifth-grade level classrooms in local schools.

Study Overview

The purpose of the research study is to examine the impact of peer interactions on the effectiveness of guided practice in metacognitive monitoring skill in reading comprehension. This research study will ask students in your school/classroom to participate in classroom-based intervention as part of their classroom routine, in which they have to complete two sets of assessment materials and a comprehension training in the form of eight class reading activities (20 minutes each) distributed into four weeks. This research will inform teachers and scholars how to promote and encourage higher-order thinking and positive social interactions in literacy classrooms.

Participation

Fifth-grade teachers who are willing to participate will be asked to allow students to complete reading activities with expository texts during their classroom time. The provided expository texts have been developed to match with the current classroom content topics (aligned with CCS). The reading activities associated with the expository texts augment classroom reading comprehension instruction with promoting student social interactions and students' higher-order thinking during text comprehension. The results of the study will be used to make further improvements to the classroom instruction programs with the ultimate goal of better addressing the needs of teachers and students in developing reading skills for 21st century.

Meeting

I would like to arrange a brief call or meeting with you to discuss this study further. Please let me know if you have any questions at this time and if you are willing to schedule a brief conversation in the near future.

Thank you for your time!

Ondrej Pesout
opesout[at]ncsu.edu

Appendix B – Scales and Measures

Self-Efficacy in Reading Questionnaire

We are interested in beliefs you have about your reading. Please read the following sentences and indicate the answer from 1 (not at all true of me) to 4 (very true of me) that is related to you and the way you are when you are doing schoolwork or homework. Please, be honest in your answer.

not at all true of me = 1 2 3 4 = very true of me

- _____ 1. I know that I will do well in reading next year.
- _____ 2. I am a good reader.
- _____ 3. I learn more from reading than most students in the class.
- _____ 4. I am confident that I understand what I read.
- _____ 5. I can do well when tested on what I read.
- _____ 6. When I don't understand something while I'm reading I know a strategy that can help me.
- _____ 7. After I read something I can usually explain what I read to others.
- _____ 8. If my teacher shows me something to help me read better, I know I can do it.
- _____ 9. I'm sure I could understand the main idea of a new story I read.
- _____ 10. When I'm reading and I get stuck I can find figure out the problem.

Note. First three items were adapted from Wigfield and Guthrie (1997), the following seven item were developed by the researchers.

Achievement Goals Questionnaire

This questionnaire aims to gain a better understanding of your goals for studying in the course. Please indicate your opinion about each of the statements below in reference to your current situation. The following statement is _____ of me. Please, be honest in your answer.

not at all true of me = 1 2 3 4 = very true of me

- ___ 1. It is important for me to do better than other students.
- ___ 2. It is important for me to do well compared to others in my courses.
- ___ 3. My goal in class is to get a better grade than most of the other students.
- ___ 4. I worry that I may not learn all that I possibly could in class.
- ___ 5. Sometimes I'm afraid that I may not understand the content of class as thoroughly as I'd like.
- ___ 6. I am often concerned that I may not learn all that there is to learn in class.
- ___ 7. I want to learn as much as possible from class.
- ___ 8. It is important for me to understand the content of my courses as thoroughly as possible.
- ___ 9. I desire to completely master the material presented in my courses.
- ___ 10. I just want to avoid doing poorly in class.
- ___ 11. My goal in class is to avoid performing poorly.
- ___ 12. My fear of performing poorly in class is often what motivates me.

Metacognitive Awareness Inventory (5th grade version)

We are interested in what learners do when they study. Please read the following sentences and provide a number to the answer that relates to you and the way you are when you are doing schoolwork or homework. Please, be honest in your answer.

never = 1 2 3 4 = always

- ___ 1. I know when I understand something
- ___ 2. I can make myself learn when I need to.
- ___ 3. I try to use ways of studying that have worked for me before.
- ___ 4. I know what the teacher expects me to learn.
- ___ 5. I learn best when I already know something about the topic.
- ___ 6. I draw pictures or diagrams to help me understand while learning.
- ___ 7. When I am done with my schoolwork, I ask myself if I learned what I wanted to learn.
- ___ 8. I think of several ways to solve a problem and then choose the best one.
- ___ 9. I think about what I need to learn before I start working.
- ___ 10. I ask myself how well I am doing while I am learning something new.
- ___ 11. I really pay attention to important information.
- ___ 12. I learn more when I am interested in the topic.

Reading Enjoyment Scale

This inventory aims to gain a better understanding of your attitudes towards reading. Please indicate your opinion about each of the statements below in reference to your current situation. Please, be honest in your answer.

not at all true of me = 1 2 3 4 = very true of me

- ___ 1. I read only if I have to.
- ___ 2. I like talking about books with other people.
- ___ 3. I would be happy if someone gave me a book as a present.
- ___ 4. I think reading is boring.
- ___ 5. I enjoy reading.
- ___ 6. I like reading at school.
- ___ 7. I like reading in my own time — not at school.
- ___ 8. I feel good about how well I read.
- ___ 9. Reading is very easy for me.
- ___ 10. I do not read as well as other students in my class.
- ___ 11. Reading aloud is very hard for me.¹

¹ Item removed to improve internal reliability of the scale

Cooperative, Competitive and Individualistic Learning Styles

This questionnaire aims to gain a better understanding of your preferred way to work on tasks in the presence of others. Please select a number to indicate how true each statement is of you.

not at all true of me = 1 2 3 4 = very true of me

- ___ 1. I like to help other students learn.
- ___ 2. I like to do better work than other students.
- ___ 3. I don't like working with other students in school.
- ___ 4. I can learn important things from other students.
- ___ 5. I like to compete with other students to see who can do the best work.
- ___ 6. I do better work when I work alone.
- ___ 7. I like to share my ideas and materials with other students.
- ___ 8. I work to get better grades than other students do.
- ___ 9. I like to work with other students.
- ___ 10. I try to share my ideas and materials with other students when I think it will help them.
- ___ 11. I am happiest when I am competing with other students.
- ___ 12. I like work better when I do it all myself.
- ___ 13. I like to cooperate with other students.
- ___ 14. I like to be the best student in the class.
- ___ 15. It bothers me when I have to work with other students.
- ___ 16. Students learn lots of important things from each other.
- ___ 17. I like the challenge of seeing who is best.
- ___ 18. I would rather work on schoolwork alone than with other students.

- ___ **19.** It is a good idea for students to help each other learn.
- ___ **20.** I don't like to be second.
- ___ **21.** Working in small groups is better than working alone.
- ___ **22.** Competing with other students is a good way to work.

Appendix C – Task Material Examples

Worksheets including a filler task (for individual and competitive conditions)

Name _____ Date _____

Knowledge Task:
Use the following page to show everything that you know about: **Glaciers**
You have 1 minute to provide as much as you can. You can write a text, list bullet points, or draw a picture.

2

Name _____ Date _____

Glaciers

Glaciers are large, moving masses of ice. They cover about 10% of the Earth's land area and most often are found near the North and South Poles. Glaciers are usually found in areas that have cold, snow winters and cool summers. These conditions ensure that all of the snow is not lost during the summer. Glaciers form when snow remains in an area long enough to turn into ice. Ice builds up with each snowfall and the weight of the glacier grows. When it gets heavy enough flows outward and downward. Glaciers are often called rivers of ice, but they do not really move like a river. A river is moving, flowing water, while a glacier is a thick layer of ice that moves in two different ways. Glaciers can slide on top of a thin layer of water that has melted beneath the glacier or water can work its way through cracks in the glacier. Glaciers also move when ice layers deep within the glacier "creep" over one another.



Valley Glacier



Ice Sheet



Iceberg

There are many types of glaciers. *Valley glaciers* are long, narrow glaciers that are found all over the world. They fill the valleys between mountains. *Ice sheets* are very large, flat glaciers that occur only in Antarctica and Greenland. To be called an ice sheet a glacier must be over 50,000 square kilometers. When the edges of a large ice sheet extend out over water they are called *ice shelves*. When a large chunk of ice breaks off an ice shelf and falls into water it is called an *iceberg*. This process is called calving. Most of an iceberg is located under the water, only 10% can be seen above the water line. *Ice caps* are small, flat ice sheets that form on land in high elevations. They can be found in parts of Iceland. Ice caps are less than 50,000 square kilometers in size. *Ice fields* are valleys where large glaciers run together. The shape of the ground beneath the ice influences the way the ice flows. Mountaintops can often be seen jutting through ice fields. *Hanging glaciers*, also

called ice aprons, cling to the steep slopes of mountains. Hanging glaciers are wider than they are long. These glaciers are common in the Alps, a mountain range in Europe. They often cause avalanches when the ice becomes so heavy that they slide down the steep slopes.

4

Response Sheet:

1. Glaciers are often called "rivers of ice" even though glaciers

- A. Do not move like rivers.
- B. Are really frozen rivers.
- C. Are not made out of ice.
- D. Move faster than rivers.

Mark how confident you are that your answer is correct.

<input type="checkbox"/>
0 10 20 30 40 50 60 70 80 90 100
Confident % Confident %

2. The word *creep* as it is used in this reading passage means

- A. To move quickly.
- B. A strange person.
- C. To move slowly and gradually.
- D. To grow or spread.

Mark how confident you are that your answer is correct.

<input type="checkbox"/>
0 10 20 30 40 50 60 70 80 90 100
Confident % Confident %

3. Which of these would be a good title for this passage?

- A. How Glaciers Erode the Land.
- B. Many Types of Glaciers.
- C. Birth of an Iceberg.
- D. Avalanche.

Mark how confident you are that your answer is correct.

<input type="checkbox"/>
0 10 20 30 40 50 60 70 80 90 100
Confident % Confident %

4. Calving occurs when

- A. A calf is born.
- B. An ice apron slides down a mountain creating an avalanche.
- C. A glacier slides down a mountain on a sheet of water.
- D. A large chunk of ice breaks off a glacier and creates an iceberg.

Mark how confident you are that your answer is correct.

<input type="checkbox"/>
0 10 20 30 40 50 60 70 80 90 100
Confident % Confident %

5. What does a person see when they are looking at an iceberg from the deck of a ship?

- A. The largest part of the iceberg.
- B. The smallest part of the iceberg.
- C. The whole iceberg.
- D. Exactly half of the iceberg.

Mark how confident you are that your answer is correct.

<input type="checkbox"/>
0 10 20 30 40 50 60 70 80 90 100
Confident % Confident %

Text Interest						
Please circle on a scale from 1 (<i>totally disagree</i>) to 5 (<i>totally agree</i>) the extent to what you agree with the statements below.						
	Totally disagree					Totally agree
	1	2	3	4	5	
I thought the passage was very interesting.						
If I had a chance, I would like to read the passage again.						
The passage really caught my attention.						
I would like to tell my friends what I learned from the passage.						

Follow-up Task (Inference making & Drawing):

In the next 4 minutes, complete the following task.

In one or two paragraphs, explain why some ships can sink when they collide with an iceberg. Then, make a drawing of an iceberg with a description of your drawing.

Task Interdependence						
Please circle on a scale from 1 (<i>not at all</i>) to 5 (<i>absolutely</i>) the extent to what you agree with the statements below.						
	Not at all					Absolutely
	1	2	3	4	5	
The way I understood the passage depended on how well my classmates understood the passage.						
My classmates helped me to achieve my reading goal.						
My classmates made it more difficult for me to achieve my reading goal.						
I felt like I was competing with others during the reading exercise.						
I felt like I was cooperating with others during the reading exercise.						

Worksheets including a team work instructions (for cooperative and intergroup competitive conditions)

Name _____ Date _____

Knowledge Task:
Use the following page to show everything that you know about: **Glaciers**
You have 1 minute to provide as much as you can. You can write a text, list bullet points, or draw a picture.

2

Name _____ Date _____

Glaciers

Glaciers are large, moving masses of ice. They cover about 10% of the Earth's land area and most often are found near the North and South Poles. Glaciers are usually found in areas that have cold, snow winters and cool summers. These conditions ensure that all of the snow is not lost during the summer. Glaciers form when snow remains in an area long enough to turn into ice. Ice builds up with each snowfall and the weight of the glacier grows. When it gets heavy enough flows outward and downward. Glaciers are often called rivers of ice, but they do not really move like a river. A river is moving, flowing water, while a glacier is a thick layer of ice that moves in two different ways. Glaciers can slide on top of a thin layer of water that has melted beneath the glacier or water can work its way through cracks in the glacier. Glaciers also move when ice layers deep within the glacier "creep" over one another.



Valley Glacier



Ice Sheet



Iceberg

There are many types of glaciers. *Valley glaciers* are long, narrow glaciers that are found all over the world. They fill the valleys between mountains. *Ice sheets* are very large, flat glaciers that occur only in Antarctica and Greenland. To be called an ice sheet a glacier must be over 50,000 square kilometers. When the edges of a large ice sheet extend out over water they are called *ice shelves*. When a large chunk of ice breaks off an ice shelf and falls into water it is called an *iceberg*. This process is called *calving*. Most of an iceberg is located under the water; only 10% can be seen

above the water line. *Ice caps* are small, flat ice sheets that form on land in high elevations. They can be found in parts of Iceland. Ice caps are less than 50,000 square kilometers in size. *Ice fields* are valleys where large glaciers run together. The shape of the ground beneath the ice influences the way the ice flows. Mountaintops can often be seen jutting through ice fields. *Hanging glaciers*, also called ice aprons, cling to the steep slopes of mountains. Hanging glaciers are wider than they are long. These glaciers are common in the Alps, a mountain range in Europe. They often cause avalanches when the ice becomes so heavy that they slide down the steep slopes.

4

Appendix D – Points Computation in Competitive Conditions

Figure X. The example illustrating how students earned points in reading sessions

Example of computing points for a single item

- Four different examples will help you understand how the passage score is calculated for an individual item

Question Example

4. Why did the stranger take the paper dragon outside without permission?

A. He wanted to show it to a friend.
 B. He did not think the family would mind.
 C. He wanted to steal the dragon from the family.
 D. He knew the dragon was special and needed to be free.

Mark how confident you are that your answer is correct.

0	10	20	30	40	50	60	70	80	90	100
Confident %					Confident %					

• Students will mark their answer and their confidence judgment.

✔

○

D is a correct answer to this question!

4. Why did the stranger take the paper dragon outside without permission?

A. He wanted to show it to a friend.
 B. He did not think the family would mind.
 C. He wanted to steal the dragon from the family.
 ✔ D. He knew the dragon was special and needed to be free.

Mark how confident you are that your answer is correct.

0	10	20	30	40	50	60	70	80	90	100
Confident %					Confident %					

A student earns the full amount of points for a correct answer.
Answer points: 100 pts.

Student is confident in the answer.

4. Why did the stranger take the paper dragon outside without permission?

A. He wanted to show it to a friend.
 B. He did not think the family would mind.
 C. He wanted to steal the dragon from the family.
 ✔ D. He knew the dragon was special and needed to be free.

Mark how confident you are that your answer is correct.

0	10	20	30	40	50	60	70	80	90	100
Confident %					Confident %					

The judgment accurately predicts the answer is correct.
Judgment points: 100 pts.

Correct answer and high confidence

4. Why did the stranger take the paper dragon outside without permission?

- A. He wanted to show it to a friend.
- B. He did not think the family would mind.
- C. He wanted to steal the dragon from the family.
- ✓ D. He knew the dragon was special and needed to be free.

Mark how confident you are that your answer is correct.



Answer points: 100 pts.
Judgment points: 100 pts.
Total Score: 200 pts.

Correct answer and low confidence

4. Why did the stranger take the paper dragon outside without permission?

- A. He wanted to show it to a friend.
- B. He did not think the family would mind.
- C. He wanted to steal the dragon from the family.
- ✓ D. He knew the dragon was special and needed to be free.

Mark how confident you are that your answer is correct.



Answer points: 100 pts.
Judgment points: 30 pts.
Total Score: 130 pts.

Incorrect answer and low confidence

4. Why did the stranger take the paper dragon outside without permission?

- A. He wanted to show it to a friend.
- ✗ B. He did not think the family would mind.
- C. He wanted to steal the dragon from the family.
- D. He knew the dragon was special and needed to be free.

Mark how confident you are that your answer is correct.



Answer points: 0 pts.
Judgment points: 100 pts.
Total Score: 100 pts.

• Student still earns all judgment points for the accurate prediction.

Incorrect answer and high confidence

4. Why did the stranger take the paper dragon outside without permission?

- A. He wanted to show it to a friend.
- ✗ B. He did not think the family would mind.
- C. He wanted to steal the dragon from the family.
- D. He knew the dragon was special and needed to be free.

Mark how confident you are that your answer is correct.



Answer points: 0 pts.
Judgment points: 30 pts.
Total Score: 30 pts.

Appendix E. Procedure Scripts

Form A – Individual Condition		
Treatment Characteristic	Students are encouraged to work individually	
Reading Goal	To understand the provided text and correctly answer the questions related to the text passage.	“You will work independently on the reading exercise. The goal of the reading is to understand the text, correctly answer all questions and make accurate judgments.”
Before	<ul style="list-style-type: none"> • Review reading worksheets • Record students’ attendance 	
0.00 - 1.00 min	Knowledge Task	“You have one minute to show me everything you know about <i>title here</i> . You may write a text, use bullet points, and you may draw pictures, but do not begin until I tell you to start.”
1.00 – 13.00 min	Reading Passage with Response Sheet <ul style="list-style-type: none"> ○ One minute left reminder 	“Rip the front page off.” “Write your name on the next page. Start with the next reading task. You will have twelve minutes to read the passage about <i>[passage title]</i> and answer the five multiple-choice questions and make five confidence judgments.” Please make sure that you complete both answer <u>and</u> judgments before you move on to the next task.” <ul style="list-style-type: none"> ○ “One minute is remaining to complete your answers.”
13.00-14.00 min	Interest Scale <ul style="list-style-type: none"> ○ Students drop their pens and submit their worksheets. 	“Please, make sure that you completed all five answers and all five judgments. Now, it is the time to complete the table called text interest and circle the numbers that matches your

		feelings how much you agree with the statements.“ Submit the worksheets and the passages to me.”
14.00-18.00 min	Follow-up Task	“In the next four minutes, complete the provided follow up task. Follow the directions on the worksheet
18.00-19.00 min	Complete worksheet	“Please complete the table on the last page and submit your last list with all the answers.”
19.00-20.00 min	Correct answers	“Here are the correct answers to the five questions:” “Please reflect on your answers and on your confidence judgments. The aim is to improve both your comprehension and your accuracy in confidence judgments”

Form B – Competitive Condition		
Treatment Characteristic	Students are encouraged to outperform their classmates	
Reading Goal	To understand the provided text and try to have more correct answer than others.	“During the independent work you will earn your own points for correct answers and accuracy of your judgments. Based on your points you will be compared to each other at the end of the session.”
Before	<ul style="list-style-type: none"> • Review reading worksheets and check pages • Record students’ attendance 	
0.00 - 1.00 min	Knowledge Task	"You will have one minute to show me everything you know about <i>dragons</i> . You may write a text, use bullet points, and you may draw pictures, but do not begin until I tell you to start."
1.00 – 13.00 min	Reading Passage with Response Sheet <ul style="list-style-type: none"> ○ One minute left reminder 	““Rip the front page off.” “Write your name on the next page. Start with the next reading task. You will have twelve minutes to read the passage about [<i>passage title</i>] and answer the five multiple-choice questions and make five confidence judgments.” Please make sure that you complete both answer <u>and</u> judgments before you move on to the next task.” <ul style="list-style-type: none"> ○ “One minute is remaining to complete your answers.”
13.00-14.00 min	Interest Scale <ul style="list-style-type: none"> ○ Students submit their worksheets. 	“Please, make sure that you completed all five answers and all five judgments. Now, it is the time to complete the

		<p>table called text interest and circle the numbers that matches your feelings how much you agree with the statements.“</p> <ul style="list-style-type: none"> ○ Submit the worksheets and the passages to me.”
14.00-18.00 min	Follow-up Task	<p>“In the next four minutes, write three paragraphs about the story. In two paragraphs describe how the dragon looked like when it was hanging on the wall, and how it looked after changing into a real life dragon. In the last paragraph, describe what you think happens to the dragon after it becomes real and starts to fly.”</p>
18.00-19.00 min	Complete worksheet	<p>“Please complete the table on the last page and submit your last list with all the answers.”</p>
19.00-20.00 min	<p>Correct answers</p> <ul style="list-style-type: none"> ○ Leaderboard 	<p>Here are the correct answers to the five questions:”</p> <p>“Please reflect on your answers and on your confidence judgments. The aim is to improve both your comprehension and your accuracy in confidence judgments”</p>

Form C – Cooperative Condition		
Treatment Characteristic	Students are encouraged to work cooperatively	
Reading Goal	To understand the provided text and help teammates to understand the text passage.	After independent reading exercise, you will discuss the reading passage in your team group. The goal of the reading is to understand the passage, and help your teammates with their understanding.
Before	<ul style="list-style-type: none"> • Review reading worksheets • Record students' attendance • Set up classroom for smooth transition into team discussion 	
0.00 - 1.00 min	Knowledge Task	You have one minute to show me everything you know about <i>title here</i> . You may write a text, use bullet points, and you may draw pictures, but do not begin until I tell you to start."
1.00 – 13.00 min	Reading Passage with Response Sheet <ul style="list-style-type: none"> ○ One minute left reminder 	"Rip the front page off." "Write your name on the next page. Start with the next reading task. You will have twelve minutes to read the passage about [<i>passage title</i>] and answer the five multiple-choice questions and make five confidence judgments." Please make sure that you complete both answer <u>and</u> judgments before you move on to the next task." <ul style="list-style-type: none"> ○ "One minute is remaining to complete your answers."
13.00-14.00 min	Interest Scale <ul style="list-style-type: none"> ○ Students drop their pencils. 	"Please, make sure that you completed all five answers and all five judgments. Now, it is the time to complete the table called text interest." <ul style="list-style-type: none"> ○ " Put your pencils down and take color pencils. Find the table of your team and sit at

		<p>the table with your number.”</p> <ul style="list-style-type: none"> ○ “You cannot change your answers or confidence judgments any more.”
14.00-18.00 min	<p>Structured Discussion</p> <ul style="list-style-type: none"> ○ First teammates’ turn ○ Second teammates’ turn ○ Third teammates’ turn ○ Fourth teammates’ turn 	<p>“In the next four minutes, each of you will take turns to discuss your understanding to the passage. The directions on the worksheet will help you get started.</p> <p>Each team member has one minute to lead the discussion with her or his teammates. You will take turns based on your seat number.</p> <ul style="list-style-type: none"> ○ “The person with number one can start with the discussion now.” ○ “The person with number two begins now ...” ○ “....”
18.00-19.00 min	Complete worksheet	<p>“Please go over your worksheets and mark if you would change your confidence judgments that you made based on the team discussion. After you are done, complete the table on the last page and submit your worksheets with answers.”</p>
19.00-20.00 min	Correct answers	<p>Here are the correct answers to the five questions:”</p> <p>“Please reflect on your answers and on your confidence judgments. The aim is to improve both your comprehension and your accuracy in confidence judgments”</p>

Form D – Intergroup Competitive Condition		
Treatment Characteristic	Students are encouraged to work cooperatively and outperform other teams	
Reading Goal	To understand the provided text and help teammates to understand the text passage in order to have more correct answers than other teams.	“After the independent work, students will form teams and discuss their passages. They will earn points collectively as the whole team. The team points will be compared at the end of the session.”
Before	<ul style="list-style-type: none"> • Review reading worksheets and check pages • Record students’ attendance • Set up classroom for smooth transition into team discussion 	
0.00 - 1.00 min	Knowledge Task	“You will have one minute to show me everything you know about <i>dragons</i> . You may write a text, use bullet points, and you may draw pictures, but do not begin until I tell you to start.”
1.00 – 13.00 min	Reading Passage with Response Sheet <ul style="list-style-type: none"> ○ One minute left reminder 	“Rip the front page off.” “Write your name on the next page. Start with the next reading task. You will have twelve minutes to read the passage about <i>[passage title]</i> and answer the five multiple-choice questions and make five confidence judgments.” Please make sure that you complete both answer <u>and</u> judgments before you move on to the next task.” <ul style="list-style-type: none"> ○ “One minute is remaining to complete your answers.”

13.00-14.00 min	<p>Interest Scale</p> <ul style="list-style-type: none"> ○ Students drop their pens and submit their worksheets. 	<p>“Please, make sure that you completed all five answers and all five judgments. Now, it is the time to complete the table called text interest and circle the numbers that matches your feelings how much you agree with the statements.”</p> <ul style="list-style-type: none"> ○ “ Put your pencils in the basket, and draw a color pencils and one in number in the basket. Find your seat that matches the color of your pencil and number that you got.”
14.00-18.00 min	<p>Structured Discussion</p> <ul style="list-style-type: none"> ○ First teammates’ turn ○ Second teammates’ turn ○ Third teammates’ turn ○ Fourth teammates’ turn 	<p>“In the next four minutes, each of you will take turns in discussing your answers and your confidence in your answers with your teammates. This will help you share with other students your text understanding. Each team member has one minute to share her or his answers with the other teammates. I will keep the discussion timed and always remind when the team members switch their turns.”</p> <ul style="list-style-type: none"> ○ “First minute starts now, the teammate number one can pick and choose the question he or she wants and discuss and share her/his answer and confidence with the teammates to improve their understanding and their overall team score.” ○ “Second teammate will take the turn...” ○ “....”

18.00-19.00 min	Complete worksheet	“Please go over your worksheets and mark if you would change your confidence judgments that you made based on the team discussion. You cannot change your answers. After you are done, complete the table on the last page and submit your worksheets with answers.”
19.00-20.00 min	Correct answers Leaderboard	Here are the correct answers to the five questions:” “Please reflect on your answers and on your confidence judgments. The aim is to improve both your comprehension and your accuracy in confidence judgments”

Appendix F - Teacher Checklist Example

Intervention session: #7 Hellen Keller	
Teacher: Mrs. Taylor	Day: 03/23/17
Beginning of the intervention session:	(hh:mm) 10.00 am
The end of the intervention session:	(hh:mm) 10.21 am
Please <u>circle</u> on a scale from 1 (<i>did not follow at all</i>) to 7 (<i>followed exactly</i>) below to what extent did the intervention followed the scripted procedure.	
Did not follow at all	
Followed exactly	
1 2 3 4 5 6 7	
Notes and comments: Students were saying that the passage was easy.	

Appendix G – Interview Protocol

Set of questions at the first interview session of the intervention

1. Do you think that you are a good reader? Why?
2. How can you become a better reader?
3. What do you do when you come to a word or sentence you don't understand?
4. How do you know when you understand what you have read?
5. What could you do to help you understand the information in the text?
6. When you are answering questions how can you tell which words or sentences in the text you read are the most important?
7. When you read do you usually read with someone else or do you read alone? Do you prefer reading along with someone else or do you like reading on your own?
8. Did you like the reading task today?
9. Was there anything that made you happy/annoyed about the reading task?
10. Do you think that you will do better or worse in the next reading task session?

Set of questions at the eighth session of the intervention

(a – only students in cooperative and intergroup competitive settings, b – only students in individual or competitive settings)

1. Do you think that you are a good reader? Why?
2. How can you become a better reader?
3. How did you like the reading task today?
4. Was there anything that made you happy/annoyed about the reading task?
5. Did you like the reading tasks over the last four weeks?
6. What have you learned about reading over the past couple reading tasks?
7. Have you noticed any difference in how you approach the tasks in reading passages over the last four weeks?
- 8a. When you worked in your team what strategy/ies did you use to answer the questions in the reading passages?
- 8b. When you were working alone what strategy did you use to answer the question on the reading passages?
9. If you had a choice, would you read rather with someone else or would you rather read alone?