Do Friends Help or Hinder? Examining Co-regulation in Kindergarteners

by

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To my mother Suzanne and my father Michael, whose unconditional love and support have seen me through it all. This dissertation is merely a symbol of the tremendous sacrifices you both have made to help me become the man I am today.

I'll love you forever, I'll like you for always…

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ABSTRACT

Research has established the importance of self-regulation skills for young children's academic success (e.g., McClelland et al., 2007), but more recent work has focused on *co-regulation*, or ways in which peer interactions impact students' regulatory performance (e.g., Whitebread et al., 2007; McCaslin, 2009; Neitzel, 2009). The present studies examined ways in which children's individual self-regulation abilities and peer relationships impact how they co-regulate with other students during a group self-regulation assessment and a collaborative problem-solving task, as well as how teacher decisions impact these interactions. One hundred fifty students aged 5 to 7 from 11 kindergarten classrooms were assessed on their individual self-regulation and academic achievement, as well as their peer nominations. During a subsequent visit, students were paired based on 1) their regulatory ability (low or high, relative to the class median) and 2) their friendship status (friends or non-friends, according to teacher nominations). Student pairs were videotaped completing an established measure of self-regulation/executive function called the Head-Toes-Knees-Shoulders (HTKS; Ponitz et al., 2009) and a challenging tangram puzzle task (Berhenke, 2013). The tangram task was coded for co-regulating behaviors. Finally, teachers completed surveys on their awareness of student regulatory skills and peer connections in the classroom, as well as the basis for their instructional decisions about student grouping in the classroom. Results revealed that regulatory pair type (e.g., High/High, Low/Low, Low/High) impacted students' change in HTKS performance from individual to paired contexts, but peer status did not. Conversely, peer status impacted students' success on the tangram task, but not regulatory pair type, providing evidence to support the importance of task type as a

context affecting the group dynamic. Additionally, results showed a main effect of gender and a peer status by pair type interaction effect on one specific co-regulating behavior—preventative directing language. Finally, teacher surveys revealed that teachers are most concerned with separating behavior problems and least concerned with reinforcing existing friendships when making classroom grouping decisions. Teachers were found to be moderately accurate when assessing peer connections in the classroom. Implications for future research and opportunities for collaboration with educators are discussed.

CHAPTER ONE

Introduction

Upon entering formal schooling for the first time, young children bring with them a unique set of experiences, as well as varying levels of cognitive, social, and emotional abilities. These abilities, coupled with environmental factors help determine how well children adjust to the new demands they face in the classroom. Many of these demands implicate self-regulation skills (Rimm-Kaufman et al., 2009; for a detailed discussion on self-regulation, see Chapter 2). For example, children are expected to remember instructions and procedures, focus attention on different stimuli throughout the day, and inhibit dominant responses in favor of subdominant responses (e.g., raising a hand rather than calling out an answer). Furthermore, children must learn to regulate their cognition and emotion within a dynamic system of peer interactions for the majority of the school day; thus, their development does not occur in isolation. While children may exhibit a certain level of self-regulation in a one-on-one situation with an adult, understanding how children develop various regulatory skills among their peers will help both researchers and educators better understand how to foster school readiness among young children.

Problem Statement

While research on the development of self-regulation skills has been abundant in the last few decades, work on this topic has uncovered some critical issues to be addressed. First, as the term self-regulation implies, studies of this construct have largely addressed how one's

individual skills lead to specific outcomes, namely academic achievement in various domains (e.g., Schoda, Mischel, & Peake, 1990; McClelland et al., 2007), as well as emotional and social well-being within specific contexts (e.g., Eisenberg et al., 1997). However, as educators well know, student behavior does not occur in a vacuum. The way a student behaves in a one-on-one situation receiving a battery of assessments from an adult is often very different than how they behave in a more typical classroom situation—that is, with peers. Thus, research must begin to examine ways in which self-regulation skills develop alongside their peers in a more realistic classroom context. This involves understanding the complex and ever-changing nature of peer relationships at a young age and how this relates to children's development. While much of the research on peer relationships at school entry identifies them as support systems, there are complexities within these early interpersonal connections that research has only just started to explore. Additionally, studies of self-regulation in young children must take into account how educators think about this concept, as well as the specific strategies teachers use to instill and enhance regulatory skills within their students. Research has certainly shown that early elementary teachers are aware of these skills, as one study indicated that as many as 46% percent of kindergarten teachers reported that over half of the students entering their class did not have basic regulatory skills needed to succeed in school (Rimm-Kaufman, Pianta, & Cox, 2000). However, although educators and parents may be generally aware of how regulated children are, there is less awareness of which specific skills to reinforce, both in the classroom and at home. Increasing this awareness requires a more collaborative effort on the part of researchers, educators, and parents to better understand how research can inform education and subsequently impact child development. It is not a goal of the current work to prescribe a specific set of strategies for teachers to use; instead, it will highlight insights ways in which educators,

researchers, and parents can better understand how children's relationships with both peers and teachers impact their development cognitively, socially, and emotionally as they begin formal schooling.

Overview of Studies

This dissertation was designed to contribute to the discussion on the aforementioned issues by examining whether and how children impact and influence each other during typical classroom activities, which I will refer to as *co-regulation* throughout the paper. With Social Cognitive Theory at its core, the primary goal of this study is to coherently investigate and integrate research on three areas: 1) classroom peer networks, 2) children's regulation, both *self-* (individual) and *co-* (in pairs), and 3) teacher decision-making. With this in mind, the dissertation is comprised of three interrelated studies that examine how children's individual self-regulation skills are impacted by peer relationships, how children impact each other during typical problem-solving situations, and how teachers understand and make decisions based on their own awareness of children's interpersonal dynamics. Study 1 examines whether and how children's individual self-regulation skills are impacted once they are placed with a classroom peer, using an established measure of behavioral self-regulation. Essentially, the focus of Study 1 is on the change in regulatory ability from individual to paired contexts. Study 2 shifts the focus solely to the group setting and investigates whether and how students influence one another, or co-regulate, during a collaborative problem-solving task. Study 3 examines the teacher perspective, specifically with regard to how teacher awareness and decisions in the classroom relate to various outcomes, including children's development of individual self-regulation skills and peer relationships.

The study was conducted in eleven kindergarten classrooms at four elementary schools in southeastern Michigan in the spring of 2014. Children (n = 150) participated in individual assessments, and the majority of children also participated in paired assessments. Teachers completed rating scales of their students, along with surveys that included questions about teacher decision-making in the classroom. Specifically, this dissertation addresses how teacher decisions in the classroom about children's seating arrangements and group work, children's individual and group regulation skills, and peer networks in the classroom all interact to influence various outcomes, including children's development of individual self-regulation skills as well as how those skills impact collaborative efforts with other students. To this end, the paper will address the following research questions:

Study 1 Research Questions—Peer Network Influences on Self-Regulation/Executive Function Task Performance in a Group Context

- Controlling for individual self-regulatory skills, what is the relation between children's peer networks (patterns of liking) and their self-regulation while in a group context? Specifically, does performance on the Head-Toes-Knees-Shoulders task in a group context significantly differ as a function of whether a child's partner is a friend?
- Similarly, does performance on the HTKS task in a group context significantly differ as a function of children's individual HTKS scores?
    - Is the number of cued trials (amount of times children looked at a partner) during the paired HTKS task impacted by peer status or pair type?
- Does paired HTKS score predict academic achievement above and beyond individual HTKS score?

Study 2 Research Questions—Children's Peer Network Influences on Group Co-regulation:

- What types of co-regulatory behaviors occur during a problem-solving task between kindergarten students, and how much do they occur?
- Is children's co-regulatory behavior during a problem-solving task influenced by whether they are friends (peer status)?
    - Also, does this factor influence how successful the pair is in solving the task?
- Is children's co-regulatory behavior during a problem-solving task influenced by each child's level of individual self-regulation (regulatory pair type)?
    - Does this factor influence how successful the pair is in solving the task?

Study 3 Research Questions—Teacher Perspectives on Classroom Dynamics:

- Regarding peer connections and children's regulatory abilities, how closely do teacher perceptions relate to the classroom reality?
    - What factors do kindergarten teachers consider most important when making decisions about how children will interact in the classroom on a daily basis (e.g., seating charts, group work), and how closely do actual seating charts reflect their beliefs?
    - How accurate is the match between teacher perceptions and student perceptions of peer connections in the classroom?
- What types of activities and strategies do teachers use to facilitate regulatory strategies and peer networks within the classroom?

Significance of the Research

While the concept of self-regulation as it develops in young children has been extensively researched and refined, there is far less research that examines the ways in which self-regulation develops *among* children interacting within the classroom. As a result, research in interpersonal

regulation is rapidly increasing. Inspired by the work of Vygotsky (1978), the focus has shifted from understanding individual self-regulation skills in early childhood to understanding how the social context can have an impact on the patterns of self-regulatory performance (e.g., Whitebread et al., 2007; Neitzel, 2009). Researchers have started to address this issue in order to clarify the concept of co-regulation in younger children (McCaslin, 2009). However, few, if any, studies examine the ways in which peer connections influence children's self-regulation or co-regulation skills. Furthermore, research often does not take into account teachers' perspectives on their students' regulatory abilities and friendships in the classroom. This study represents a unique step towards connecting education and psychology research because it aims to make research on child development in the classroom more accessible for educators and parents alike.

With self-regulation at its core, this dissertation aims to gain a more accurate understanding of how typical classroom processes influence child development. Self-regulation research is increasingly creating a more accurate depiction of what individual children bring to the classroom context and how this influences their development and subsequent academic achievement. Researchers must continue to study how these individual characteristics are constantly interacting in order to shape children's resulting developmental and academic outcomes. To that end, research on co-regulation is a burgeoning area, ripe for discovery and innovation. Incorporating the literature on peer networks is another logical step, and crucial to continue advancing this research if we are to truly capture the complex world of the classroom environment. Finally, including the teacher perspective provides us with a new understanding of how educators both affect and are affected by their students. Because I hope to one day be involved with the development and implementation of school interventions aimed at helping both teachers and students, I would like to continue building on ecologically valid research that

examines classroom phenomena as they actually are—complex and fascinating—much like the minds of young children.

In sum, this dissertation contributes to the field of educational psychology by providing a study that addresses some of the aforementioned methodological needs: focusing on how children's individual self-regulation skills translate to a group setting by assessing students in the classroom context with more ecologically valid measures, and including the teachers' perspectives on how children's self-regulation skills and dynamic peer ecologies in the classroom impact their instructional decision-making. Finally, an over-arching purpose of this this work is to help bridge the gap between research and practice by making the findings accessible to researchers, educators, and parents alike. Research from this study will be communicated in a non-prescriptive way. It is crucial that educators be made aware of research findings, but also that they do not feel as if they are being burdened with additional tasks and assessments for them or for their students. Instead, an effort on the part of the researchers to be as collaborative as possible will include inviting educators and parents to interpret the results for themselves, in order to establish a productive relationship and continue to inform future work on these topics.

Organization of the Dissertation

In order to address the objectives outlined above, the dissertation consists of six chapters. Chapter 2 presents the following: a) a literature review of self-regulation and executive function, b) a review of previous work on peer relationships in early classroom contexts, c) an examination of the work on co-regulation, and d) a brief overview of sociometrics as it relates to the current studies, and e) a brief description of the three dissertation studies. Chapters 3, 4, and 5 will detail each of the three dissertation studies. Chapter 3 will provide the methods and results for Study 1,

which examined the ways in which children's self-regulation skills differed from an individual assessment to a paired assessment. Chapter 4 will provide the methods and results for Study 2, which focused on the types of co-regulating behaviors that pairs of children exhibited during a puzzle task. Chapter 5 will address the methods and results for Study 3, which used a survey to investigate the teachers' decision-making and awareness of children's regulatory abilities and peer connections. Specifically, this chapter provides qualitative information on how teacher understanding of student self-regulation and peer relationships, as well as their instructional decision-making compared to the actual student behaviors that occurred in Studies 1 and 2. Each of these chapters will have their own respective discussions and implications for both educators and researchers. Chapter 6 provides a general discussion that integrates the results of the three studies together, including implications for theory and practice, limitations of the study, and directions for future work.

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CHAPTER TWO

Review of Literature

Self-Regulation

Traditionally, self-regulation refers to a complex set of acquired, intentional skills involved in controlling, directing, and planning one's cognitions, emotions, and behavior (Schunk & Zimmerman, 1997). Essentially, it is the ability to control and direct one's own thoughts, feelings, and actions in order to achieve a goal. Self-regulation has been widely studied, but along with the growing interest in this construct comes considerable debate about its definition and components in early childhood. The wide range of literature on self-regulation treats it as an umbrella term, which covers several concepts, including but not limited to: delay of gratification (Mischel & Rodriguez, 1993), effortful attention (Kochanska, Murray, & Harlan, 2000), motor control, executive function, ego control, inhibitory or effortful control, emotion regulation, and externalizing behavior problems (McCabe, Cunnington, & Brooks-Gunn, 2004). The boundaries between these different concepts are unclear. Not surprisingly, difficulty in defining this concept has led to confusion about which skills to measure as well as how to measure them.

Despite the issues in coming up with a cohesive framework for the construct itself, self-regulation has been clearly linked to a variety of positive outcomes for young children. In early childhood, the ability to regulate emotions is associated with secure attachment (Vondra, Shaw, Swearingen, Cohen, & Owens, 2001), emotional knowledge (Schultz, Izard, Ackerman, &

Youngstrom, 2001), social competence (Denham et al., 2003), conscience (Kochanska, Murray, & Coy, 1997), and resiliency (Eisenberg, Guthrie, et al., 1997) in early to middle childhood. Additionally, difficulties with emotion regulation predict later problematic behavior such as impulsivity, delinquency, antisocial behavior, aggression, Attention Deficit Hyperactivity Disorder, conduct disorder, and Oppositional Defiant Disorder (Campbell, Pierce, March, Ewing, & Szumowski, 1994; Newman, Caspi, Moffitt, & Silva, 1997). The importance of self-regulation takes on greater significance once children make the transition to formal schooling as a result of the new cognitive and social demands they face each day in the classroom. Research has linked self-regulation with academic achievement, suggesting that these skills are crucial for academic success (e.g., Shoda, Mischel, & Peake, 1990; McClelland et al., 2007). Additionally, children entering formal schooling without adequate self-regulatory skills are at significantly greater risk for peer rejection and low levels of academic achievement (Cooper & Farran, 1998; Ladd, Birch, & Buhs, 1999; McClelland, Morrison, & Holmes, 2000). As many as 46% of kindergarten teachers reported that over half of the children entering their classes did not possess the basic regulatory skills needed to succeed in school (Rimm-Kaufman, Pianta, & Cox, 2000). This trend begs the following question: What are the specific self-regulatory skills that children need to succeed in the classroom and how do they develop? Much of the research aimed at addressing these questions focuses on the development of *executive functioning* in young children.

Executive Function

Although the skills children develop to meet the demands of kindergarten are typically defined as self-regulation, the major biological capacities that children develop at this critical period in the lifespan are encompassed within the concept of *executive functioning*. Thus, executive functioning (EF) refers to the group of developing cognitive skills that form the basis

for self-regulation. These skills include processing and manipulating stimuli (*working memory*), resisting distraction and shifting tasks when necessary (*attention/flexibility*), and inhibiting automatic reactions to stimuli while initiating unnatural yet adaptive or socially acceptable reactions (*inhibitory control*) (Blair, 2002). These skills are typically used for the purpose of goal-directed action. Much of the neuro-psychological research on executive function in young children suggests that the emergence of behaviors associated with EF is dependent on the development of the prefrontal cortex at approximately the age of school entry (Luciana & Nelson, 1998). The prefrontal cortex development is especially rapid during this time period (e.g., Diamond, 2002). These biological changes constitute a unique component of the transition to formal schooling. During this period, children begin to develop new cognitive abilities such as enhanced memory, new reasoning abilities, and new strategies for recall (Flavell, 1988). This cognitive capacity, or readiness, to take on the new demands of the classroom environment largely determines how children adjust to school. Additionally, intelligence is no longer thought to be the dominant predictor of academic success. There is much evidence to support the importance of executive function for students' academic outcomes throughout school. Duckworth and Seligman (2005) found evidence that the ability to self-regulate has a greater influence on academic performance than does IQ. Another study by the National Institute for Child Health and Human Development Early Child Care Research Network (2003) found that better attention on a tedious computer task predicted better reading and math achievement in 54-month-old children. Additionally, Blair and Razza (2007) found that levels of inhibitory control in preschool predicted kindergarten reading and mathematics achievement. Thus, research has linked the ability to focus one's attention, remember and manipulate multiple pieces of information, and inhibit dominant responses in favor of subdominant responses to higher

academic achievement. It is clear that the biological changes related to EF development occurring within children around the time they enter kindergarten have a large impact on their self-regulatory abilities and in turn, the ways they adjust to the new cognitive and social demands of formal schooling.

Self-Regulated Learning

At this point, it is important to distinguish between *self-regulation* and *self-regulated learning* (SRL). Among older students, self-regulation has been applied to learning strategies, and has been studied as *self-regulated learning* (e.g., Pintrich & De Groot, 1990). This term often refers to the process by which students 1) set goals and plan strategically, 2) implement the strategy, 3) monitor progress, and 4) evaluate the strategy and outcome (Zimmerman, 1999; see Figure 2.1).

Figure 2.1. Zimmerman's (1999) model of self-regulated learning.

Though very similar, the concept of SRL is slightly more specific than that of self-regulation. Whereas the former applies to specific strategies being used, the latter focuses on the cognitive and behavioral skills in young children that set the stage for the use of self-regulatory

strategies later on (e.g., studying). For example, self-regulated learning focuses on specific strategies for self-observation, such as self-recording a behavior (Schunk et al., 2008), while the study of self-regulation focuses on attentional control, a skill that would be necessary for any form of self-observation. One proposed way to think about EF, self-regulation, and self-regulated learning is on a spectrum from a more theoretical conceptualization to a more applied one (see Figure 2.2).

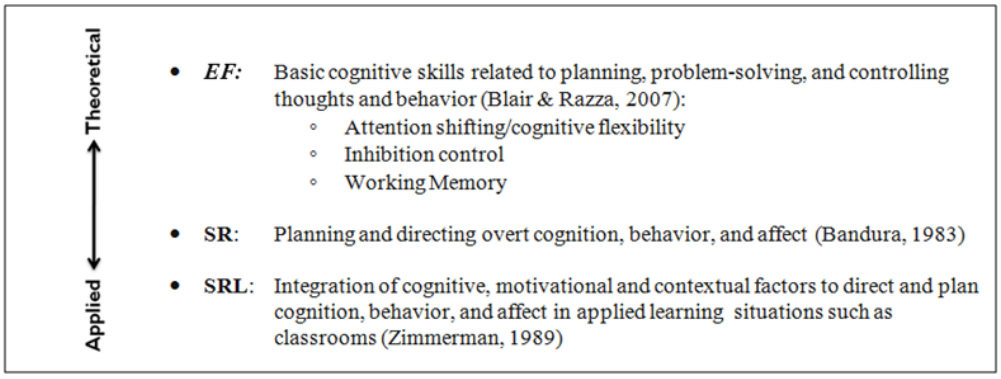

Figure 2.2. Proposed spectrum from theoretical to applied that includes EF, SR, and SRL.

Students who use the more applied SRL skills systematically are more likely to also use help-seeking strategies in order to find ways to succeed in school (e.g., Karabenick & Newman, 2006), use more efficient problem-solving strategies (Hmelo-Silver, 2004), are more interested in academic tasks (Ainley, Hidi & Berndorff, 2002), and are more likely to have achievement learning goals based on mastering the material to be learned (Pintrich & De Groot, 1990; Berger & Karabenick, 2011). However, as mentioned, less is known about how SRL develops in younger children. Self-regulated learning becomes an important concept to address when examining how young children interact during a problem-solving task in a classroom setting. While children will certainly have varying levels of individual cognitive and behavioral (EF) skills, it is unclear how these individual skills remain static or change as a result of contextual

factors, namely, interacting with peers. Thus, it is important to examine the interplay between children's individual self-regulatory skills and, the ways in which they may either enhance, or detract from the collaborative group effort when working with their peers toward a particular goal.

Motivation

Children's achievement motivation has been an important topic of research for years to the educators, researchers, and parents who strive to help all children reach their full potential in school. Motivation is related to greater learning in school, controlling for IQ (Skinner, Zimmer-Gembeck, & Connell, 1998) and with greater interest, engagement, performance, and well-being (Bandura, 1997; Deci & Ryan, 1985, 2000). In this study, *achievement motivation* is defined as "the process whereby goal-directed activity is instigated and sustained" (Schunk, et al., 2008, p.4) and operationalized by behaviors, emotions and beliefs, such variables as persistence, pride, self-efficacy beliefs, intrinsic interest/liking, and goal orientation. While this dissertation will not explicitly detail each of these constructs, it is clear that motivation is a far-reaching concept that certainly has educational implications. More recent research has connected motivation to self-regulation in young children (e.g., Berhenke, 2009; Berhenke et al., 2011). Specifically, aspects of self-regulation (conceptualized as executive function) overlap with motivation and independently predict academic growth. For example, persistence during a puzzle task was correlated with classroom measures of executive function (Berhenke, 2013), supporting the notion that persistence should be considered both a motivational and EF variable, or at least a manifestation of these constructs. While this study does not make specific hypotheses about motivational components, it nonetheless measures them in order to continue to address the complex relations between motivation and self-regulation as they develop in early childhood.

Co-Regulation Defined

While the concept of self-regulation in young children has been extensively researched and refined, there is far less research that examines the ways in which self-regulation develops among children within the classroom setting. Research in interpersonal regulation of learning and motivation is rapidly increasing. Led by the pioneering work of Vygotsky (1978), the focus has shifted from understanding individual self-regulation skills in early childhood to understanding how the social context can have an impact on the patterns of self-regulatory performance (e.g., Whitebread et al., 2007). Subsequently, researchers have given increasing attention to the context in which the regulatory process takes place as well as the social and emotional components involved in this process (Boekaerts & Corno, 2005). In other words, research is now conceptualizing self-regulated learning as a process that is intrinsically socially shared in nature (e.g., Volet, Vauras, & Salonen, 2009b). As a result, new constructs have been proposed, specifically *co-regulation, co-regulated learning* (CoRL) and *socially shared regulation of learning* (SSRL) (Hadwin et al., 2011). Generally, the concept of co-regulation refers to "the overall dynamic regulatory process by which the social environment supports individuals' internalization of social and cultural influences" (Volet, et al., 2009b, p. 218). This definition is further specified to include group activities that bring together "multiple self-regulating agents [who] socially regulate each other's learning" (Volet et al., 2009a, p. 129). Individual, social entities (e.g. groups) and social contexts (e.g., educational communities) are conceptualized as self-regulating and co-regulated systems at the same time (Volet et al., 2009b). Similarly, McCaslin (2004, 2009) refers to co-regulation as the relationships among cultural, social, and personal sources of influence that together challenge, shape, and guide ("co-regulate") identity. Further, Hadwin and colleagues (2011) define *co-regulation of learning*

(CoRL) as the temporary coordination of self-regulation amongst self and others. Essentially, co-regulation encompasses a dynamic exchange that results in individual behaviors interacting with and potentially modifying one another based on individual characteristics of the group participants. Additionally, the context in which this takes place often dictates what is exchanged, and what behaviors are necessary for socially acceptable co-regulation to occur. As with the definition of self-regulation, this dissertation will not detail the nuanced differences in definitions around similar concepts, but will adopt the term *co-regulation* to refer to the phenomenon of intentional regulatory behaviors occurring between individual children that influence another's behavior while in a group context.

Co-Regulation in the Classroom

Studies of SRL during the last decade have focused on collaborative work in the classroom, due to a growing interest in collaborative processes in the educational context. Practically speaking, many educators, from the time children enter formal schooling to the university level, use group work in order to foster learning and collective competencies. Typically, the main goal of such activities early on is often the development of children's basic social skills. Such skills might include: taking turns speaking in a conversation, sharing resources, and otherwise cooperating with others in order to reach a collective goal. Research has focused on students' productive engagement in peer-interactions (Volet, Summers, & Thurman, 2009a), shared regulation of the joint activity (Hadwin & Oshige, 2011), and the relationship between group-work and social and emotional aspects of peer-interaction (Baines, Blatchford, & Chowne, 2007). Thus, collaborative group-work has been recognized as an important context for the development of individual self-regulation, as well as metacognition. It has been observed that during episodes of collaboration, cognitive regulation processes fluctuate among three levels:

self, other, and shared regulation (Grau & Whitebread, 2012). In this context, *self-regulation* refers to the monitoring and control of individual performance. *Other-regulation* relates to the situation in which one partner masters a key element of the task but the other(s) does not, therefore the partner instructs the other(s). *Shared regulation* refers to "the processes by which multiple others regulate their collective activity. From this perspective, goals and standards are co-constructed" (Hadwin & Oshige, 2011; p. 253-254). Despite having distinct definitions, the difference between other-regulation and shared regulation as it occurs in early grade classrooms is unclear, as studies of collaborative group-work among students have typically focused on older children, adolescents, and university students and less often on very young children. Thus, whether the nuances between 'regulating others' and 'shared regulation' are commonly seen among young children is not well-established in the literature.

Some researchers have tried to address this issue in clarifying the concept of self-regulation and co-regulation in younger children. Studies (e.g., Whitebread et al., 2007, 2009) have identified the important distinction of regulation that is directed toward the self, and that which is directed toward others. Other studies have supported the notion that learning contexts that encourage young children to learn from one another might be beneficial in relation to aspects of self-regulated learning. For example, Whitebread and colleagues (2007) found that the presence or absence of an adult, the social context of a task (working alone, with a small group, or with the whole class) and the nature of the task, can have a significant effect upon the pattern of children's self-regulatory performance. More recently, Whitebread & Pino-Pasternak (2013) found that children were better at metacognitive regulation when working in pairs or groups, and better at emotional and motivational regulation when working individually. Neitzel (2009) compared factors of children's home environment with classroom observations of academic peer

interactions, finding evidence for the importance of parent-child communication for successful classroom interactions. Thus, the recent studies have provided some promising evidence to support the notion that children regulate themselves differently when they are alone as opposed to in a group context, particularly with classroom peers, and that these interactions with peers are influenced by several factors, including those that implicate both home and classroom environments.

The construct of regulation has been used to explain individual and social processes of adaptation, engagement, participation, learning, and development (Volet et al., 2009b). It is central to two aspects of human adaptive behavior: social dynamics (e.g., the continuous situational and developmental adjustments of an individual's behavior to environmental changes) and relationality (e.g., the functional relatedness of an individual's behavior to the behavior of others and to the characteristics of environmental objects: Fogel, 1993; Hinde and Stevenson-Hinde, 1987). In order to collaborate with others, one must regulate cognition, as well as social, affective, and motivational processes (Volet, Vauras, Khosa, & Iiskala, 2013). Volet and colleagues (2009b) developed a coding scheme for simultaneously examining individual and co-regulation as well as low and high levels of cognitive engagement with the content during a group task. The key features of the two dimensions are summarized below (see Figure 2.3). Within this coding scheme, individual regulation with low level of content processing (individual-low) would include reading verbatim, clarifying basic facts, describing, defining, or questioning for details.

Level of Content Processing

Dominant form of social regulation	Low	High
Individual (within group)	Individuals clarifying knowledge	Individuals constructing meaning
Co-regulation (as a group)	Group clarifying/ sharing knowledge	Group co-constructing knowledge

Figure 2.3. Categories of talk for coding collaborative activity (Volet et al., 2009b).

While there has certainly been a flurry of research studies examining a variety of methods of measuring interpersonal regulation among students, few, if any of these studies have taken into account the established relationships among students, including close friendships. The next section details the extensive work done on peer relationships in the classroom and how this may add a new dimension to the already ongoing work on student collaborative work.

Peer Relationships

As discussed previously, children must adjust to the new cognitive, emotional, and social demands placed upon them as they enter formal schooling. A large part of how children cope with these demands has to do with their supports. Ladd (1989) suggested that the degree to which children adapt to new challenges and become comfortable and successful in their new school environment is partly dependent on the degree of support they receive from teachers, parents, and classmates. Of these, relationships with classmates may be the most important. In addition to providing a variety of supports, peer interactions represent a context for social, emotional, and cognitive development—a context that children are certainly aware of. Research

has shown that peer connections in the classroom are of major concern to children as they enter and pass through elementary school (Levine, 1966; Rakieten, 1961). Additionally, the quality of children's peer relationships in grade school predicts school avoidance, disruption, and failure during adolescence (Parker & Asher, 1987). A study by Ladd (1990) found evidence to support the premise that early classroom peer relations are a precursor of later school adjustment. However, this study also suggested that the benefits of peer relationships may not last long unless the relationship is maintained over the course of the school year. Additionally, the study also found that children who formed more new friendships over the course of the year tended to gain in school performance. Ladd (1990) suggests that by making friends with previously unfamiliar peers in the classroom, children not only established new bases for support, "but also integrated themselves into the academic milieu in a way that fostered learning and achievement" (p. 1096). Bronfenbrenner (1979) has argued that children's learning and competence is enhanced when they are allowed to undertake new tasks in the company of familiar persons. Another explanation is that by making new friends in the classroom, children have reduced the number of "unknown" peers and in turn, created a more supportive learning environment. Furthermore, interactions and conversations between friends are marked by greater mutuality and involvement than those between non-friends (Gottman, 1983). This may indicate that friends are more attuned to each other's needs and goals and, as a result, can provide more useful support. Additionally, friends may find it easier than acquaintances to trust one another, thereby becoming more likely to expose their own views and challenge each other (Shantz & Hobart, 1989). This, in turn, could lead to more cognitive development as children become older. However, this research often looks at children in middle to late childhood as opposed to those just entering formal schooling. Because less is known about how friendships may impact

children's development of self-regulation or co-regulation in kindergarten, it is important to gather systematic data on both peer networks in the classroom and activities in which co-regulation is encouraged. First, we must clarify some of the definitional distinctions when discussing peer relationships.

Distinguishing Friendships from other Types of Peer Relations

Research on peer relationships has attempted to clarify the definition of friendship as opposed to other types of peer relationships. In many studies examining peer connections in the school setting, friendships are often defined in terms of a mutual relationship that necessitates *reciprocal liking* (Bagwell, Newcomb, & Bukowski, 1998). That is, each member of a dyad chooses the other as a friend. Furthermore, associative activities such as play behaviors and common activities that involve close proximity and frequent interaction appear to be the strongest markers of an intense tie between childhood friends (Newcomb & Bagwell, 1995). This differs from *peer relations*, which have lesser affective ties, as well as *non-friends,* which can include acquaintances, disliked peers, or strangers (Newcomb & Bagwell, 1995). Younger children tend to base their notions about friendship on specific overt characteristics, such as the activities they share with their peers (Furman, 1982). Short-term longitudinal studies conducted with young children have indicated linkages between friendship and adjustment (e.g., Ladd, 1990). Friendship relation offers a setting of intense social activity, often characterized by a willingness to share, cooperate, help, or otherwise exchange positive affect (Newcomb & Bagwell, 1995). This affective exchange component typically includes more frequent looking, smiling, laughing, and touching among friends than among non-friends. Additionally, friends engage in more conversation and talking than do non-friends.

With regard to problematic situations that arise in peer relationships, it appears that friends are more concerned than are non-friends about resolving conflicts. Hartup (1992) found that conflicts make both positive and negative contributions to friendship. The positive contributions appear to be providing experience in managing conflicts. This is likely a result of friends' greater level of investment in one another motivating them to minimize the damage caused by conflicts, whereas acquaintances are not as concerned with the negative effects that conflict may have on their relationship. Friendships are also defined by the cluster of characteristics that includes mutual liking, closeness, and loyalty (Furman, 1982). Conversely, the cluster of characteristics that includes similarity, equality, and dominance characterizes general peer relations, but not exclusively friendships (Hartup, 1983).

An important point about relationships in childhood: whereas parent-child relationships are vertical, or hierarchical in structure, child-child relationships are horizontal; that is, the participants view themselves as equals (Hartup & Moore, 1990). Although research has found that even in horizontal relationships, it is not uncommon for one individual to exert some level of dominance over his or her partner (Ross & Conant, 1992), there is evidence to support the notion that this dominance occurs less frequently between peers who share a bond of friendship (Newcomb & Bagwell, 1995). In other words, peers who consider each other to be friends appear less concerned with establishing dominance in the relationship, perhaps to support the reciprocity that allows the relationship to grow and mature.

Peer Relationships in Classrooms

Much of the research on peer relationships in early childhood has focused on the developmental significance beginning in early childhood. Specifically, intimate friendships have been found to yield positive outcomes such as validation of self-worth (Weiss, 1974), security

and emotional support (Bukowski et al., 1991), and guidance and help (Furman & Buhrmester, 1985). During the school-age years, friendships provide knowledge of behavioral norms and facilitate the development of skills in regulation of emotion (Parker & Gottman, 1989). Additionally, as a context for social development, friendship may serve two functions. First, within friendships, children have greater opportunities to learn and use competencies associated with effective interpersonal interactions (Hartup, 1989). Skills such as sharing, cooperating, and resolving conflict are skills that children are expected to become proficient in upon entering formal schooling. Naturally, children may gain more experience refining these skills in friendship relations than general peer relations. Second, friendship appears to provide a foundation for future social relationships (Hartup & Sancilio, 1986). As children develop social competencies, these are expected to provide a fundamental base for the development of other relationships.

Effects of Peers on Emotional Development

In addition to providing a context for social development, friendships also provide a context for three aspects of emotional development. First, friendships offer a chance for children to express and regulate emotions (Parker & Gottman, 1989). Second, friendships typically involve behavioral manifestations of emotion, evidenced by greater sharing, cooperation, and helping among friends than among non-friends. These aspects of friendship likely help maintain emotional homeostasis in the face of conflict. Third, friendships offer a more intense emotional experience than do general peer relations. Though the emotional benefits of friendships are certainly important and well-documented, it is also important to focus on ways in which strong peer interactions may benefit children's cognitive development.

Effects of Peers on Cognitive Development

The ways in which friendships offer a context for cognitive development are less understood. The classic cognitive theories of Piaget and Vygotsky do not specify how friendships might differentially function as a social agent in promoting cognitive development (Hartup, 1998). Azmitia and Montgomery (1993) proposed three mechanisms by which friendships might foster cognitive growth. First, friends are more likely than are nominal peers to exchange ideas in conversations, to share, and to cooperate. This is likely due to the fact that friends talk more with each other than non-friends. Second, friendships offer the opportunity for balanced, mutual involvement in collaborating effectively. Third, having success in a problem-solving scenario requires an exchange of viewpoints and testing of ideas. It is likely that greater trust among friends affords the exchange of individual perspectives, leading to increased cognitive development. Generally, findings for the impact on friendship on task performance suggest that friendship plays a major role in enhancing task performance (e.g., Newcomb & Bagwell, 1995). However, this relationship may not generalize to all tasks. For example, friends may be more successful on tasks that require creativity and spontaneity, but may be less successful when the task requires strict adherence to task structure (Newcomb & Bagwell, 1995). In a situation in which friends are following very specific parameters in order to achieve a goal, the high level of affiliation may prove to be a distraction and in turn, detract from overall performance. In other words, the moderating effect of task demands may influence whether friendship functions advantageously for the group participants.

Newcomb and Brady (1982) originally suggested that the demands of an experimental task must create the need for coordination and mutual effort if the benefits of friendship are to be apparent in task performance. Preschool relationships are based primarily on shared activities

and opportunities for play. Although these types are less stable than friendships in later childhood, they are considered to be precursors of later development (Furman, 1982). Furthermore, research has shown that early school adjustment is partly a function of the attributes and experiences that children bring to new classrooms, and partly a function of the types of relationships children experience as they cope with new settings (Ladd, 1990). One outcome of this is that children's classroom peer relationships tend to add to the prediction of school adjustment, above and beyond that which could be accounted for by their personal attributes and experiences (Ladd, 1990).

Conversely, negative types of peer relationships may adversely affect children's cognitive development. Peer rejection—defined as how consensually disliked (relative to how consensually liked) a child is by members of his or her peer group (Bukowski & Hoza, 1989)—leads to lower classroom participation, a phenomenon that persists through the primary grades (Ladd, Herald-Brown, & Reiser, 2008). Whereas participation in close relationships with classmates or teachers may offer children supports such as assistance or security, and thus facilitate adaptation, stressful ties or processes (e.g., rejection by the peer group) may promote maladjustment (Ladd, Birch, & Buhs, 1999). One factor that may play a role in whether peer relations are negative is children's individual levels of self-regulation. Children's individual behaviors are among the strongest antecedents of the relationships they form with classroom peers. Young children's use of force or coercive tactics, for example, are likely to subvert others' aims and interests (e.g., seizing toys, rejecting rules) and cause partners to develop adversarial or avoidance reactions (Ladd & Burgess, 2001). These aggressive tactics can stem from lower self-regulatory skills (e.g., not being able to inhibit the tendency to grab a marker from another student, not being able to delay gratification). Furthermore, as early as preschool, children who

are viewed by adults as well-regulated are generally more well-liked rather than rejected by peers (e.g., Gunnar, Sebanc, Tout, Donzella, & van Dulmen, 2003). Ultimately, whether children are equipped with the cognitive, social, and emotional tools to meet classroom expectations upon beginning formal schooling is a result of the individual characteristics they gain from their experiences at home or in previous childcare settings. Despite this, much of the responsibility for bringing individual personalities together in a developmentally appropriate manner, facilitating peer relationships, and providing children with a solid grasp of classroom expectations falls upon the teacher. This often involves teachers shaping classroom peer ecologies in order to ensure a safe and harmonious learning environment.

Teacher Roles in Determining Classroom Peer Ecologies

Despite the fact that considerable research has examined the importance of friendship and peer interactions among children in school and has provided us with definitions of these concepts, less research has considered the practical implications of teachers' understandings of the peer networks within their own classrooms, as well as teacher decisions that may affect classroom peer ecologies. For example, how do teachers determine which children are "friends" in the classroom, and how accurate are they in doing so? Studies have shown that many teachers have a poor understanding of classroom friendship patterns (Gest, 2006; Pearl, Leung, Van Acker, Farmer, & Rodkin, 2007). Moreover, Cillessen, Terry, Coie, and Lochman (1992) found high agreement between teacher and peer judgments of aggression, but low overall agreement between teacher and peer judgments of status. This study also found a large variation among teachers, indicating that some teachers were much more accurate than others. Thus, based on their potentially inaccurate perceptions of which students are "friends" in the classroom, how do teachers make decisions about classroom group work and seating arrangements in order to

change or maintain specific peer ecologies? While researchers have examined several nuances of how to conceptualize and measure classroom peer networks, teachers often do not have the time or resources to keep all of these considerations in mind when looking at or assessing peer connections in their own classrooms and subsequently using this information to make instructional decisions. Thus, it is important to consider research that both captures and informs the practical decision-making in which teachers engage as they influence their classroom peer ecologies.

Clearly, understanding peer relationships in the classroom has theoretical implications for early child development, but research has also started to focus more on considering the practical implications of educators fostering peer relationships from an early age. The early work of Vygotsky (1978) has inspired socio-cultural and socio-cognitive research on instructional practices and interpersonal regulation. Teacher decisions in the classroom often impact much more than instruction—they also affect how children begin to socialize with each other on a daily basis. Researchers have established that teachers play a crucial role in determining and managing classroom peer relationships (Cairns & Cairns, 1994; Gronlund, 1959; Lewin, 1943). Early research in this area was often focused on how to improve the social skills of isolated or rejected children and reduce the formation of cliques in schools (Gronlund, 1959). However, conceptual models that attempt to specify the processes involved are much more recent (Farmer et al., 2006) and less understood. This renewed emphasis on the wide variety of children's social connections has also started to implicate classroom dynamics for the development of better classroom management strategies. Thus, in order for the claim that teachers play an important role in facilitating classroom peer ecologies to hold any water, more empirical evidence that

would be used to help provide concrete strategies for teacher professional development efforts is needed.

To address the need for research-based professional development for teachers, recent research has attempted to examine teacher decision-making in a more systematic way. Gest and Rodkin (2011) claimed that teachers influence classroom social dynamics both indirectly, through general teaching practices, and more directly through active attempts to manage the social network. They define *classroom peer ecology* as a microsystem, borrowing from Bronfenbrenner (1979), which involves children interacting with, influencing, and socializing one another. Their conceptualization of the peer ecology as a central feature of the classroom context is seen below (see Figure 2.4). According to this model, classroom peer ecologies are proximal determinants of youth outcomes (Pathway A). Features of classroom peer ecologies are determined partly by general teaching practices (Pathway B) and partly by network-related teaching practices (Pathway C). Network-related teaching practices refers to more specific features of teacher-student interaction that may reflect conscious choices or strategies adopted by the teacher to impact peer relationships (Farmer, 2000; Farmer et al., 2006). For example, network-related teaching may involve creating a seating chart and organizing small group activities. It is important to note that although the model suggests these directional linkages are one-way, the researchers do concede that bi-directional (bottom-up) processes are possible (Gest & Rodkin, 2011). It is important to understand how teacher decisions affect student outcomes, but also the ways in which students themselves may influence how teachers make decisions. For example, based on students' behavior, teachers might alter their network-related teaching practices in some way, which in turn may almost certainly affect the classroom peer ecology.

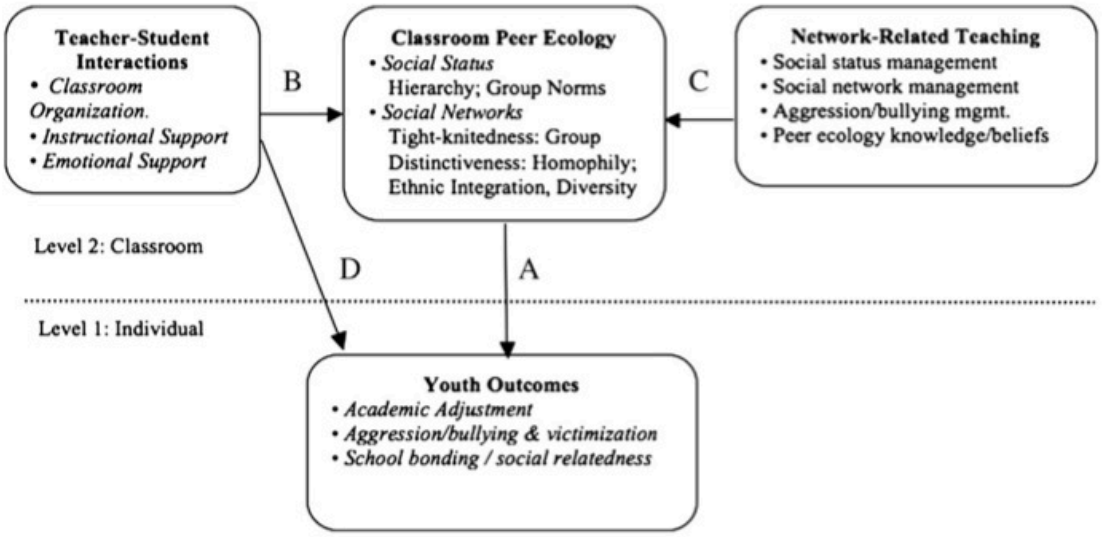

Figure 2.4. Conceptual model of teaching practices, classroom peer ecologies, and youth outcomes (Gest & Rodkin, 2011).

Generally speaking, teacher effects on classroom peer ecologies are understudied phenomena (Wentzel, 2009). The practical implications of understanding whether and how a teacher makes explicit decisions about the ways children will be arranged in the classroom are far-reaching. If a teacher decides Child A will work better with Child B than with Child C, what factors drive that decision? Would Child A's development be more enhanced if they were working more with Child C instead? How would a teacher know this? A seating chart might reflect the teacher's belief that Child A is better off sitting next to Child B on a regular basis. However, it is important to capture the underlying thinking of educators as they make network-related teaching decisions. Often, teachers will place students together that do not necessarily socialize often in or out of the classroom (e.g., on the playground). This serves the dual purposes of exposing children to the idea of learning to work with other people besides the ones they consider to be their "best friends" as well as attempting to minimize distractions. At times, teachers may also place students who they perceive as having few or no friends in the classroom next to a particularly social student, in hopes that they can foster a new friendship ("social

network management"; Farmer, 2000). Additionally, teachers separate students who may reinforce each other's behavior problems ("direct management" of aggression; Farmer, 2000). A recent experimental study by van den Berg, Segers and Cillessen (2012) changed classroom seating arrangements on the basis of peer nominations and likeability ratings in order to help students see each other more positively and to have a positive effect on classroom climate. Both aims were accomplished, lending credence to the notion that more systematic data on peer relationships could have an impact on the classroom. What remains to be seen is whether collecting data such as these could impact students self-regulation and ultimately, academic development.

The study by Gest and Rodkin (2011) found several results that are relevant to the current study. One important finding was that in classrooms where teachers reported that separating students who posed behavior problems was a major consideration in creating seating charts and small groups, there was a higher ratio of liking to disliking and a higher density of friendships. In other words, separating students who might pose behavior problems was an important consideration for most teachers in the study, as it provided a context in which positive social ties can emerge. This can be considered an active form of social network management (Farmer, 2000). Teachers that become concerned about the peer norms in their class may begin to attempt to manipulate friendship dynamics through grouping practices. However, as Gest and Rodkin (2011) speculate, it may be more beneficial for teachers to "set the stage" for friendships rather than try to directly influence them. Because researchers could potentially find an endless number of teaching strategies as well as friendship patterns within classrooms, it is important to focus research efforts on the measurement of student-student and teacher-student interactions.

Sociometry

Researchers that have empirically examined friends and non-friends have traditionally relied on variations of two methodologies (Newcomb & Bagwell, 1995). The first approach has been observing relationships, including the 'signs' that are representative of friend and non-friend relations. The second approach has been to have children respond to direct questions about themselves and who they view as friends or non-friends. Though both have advantages to researching peer interactions, the following section will discuss the latter method—specifically, sociometry.

The onset of the use of sociometry is typically attributed to Jacob Moreno. A major premise of Moreno's theory is that the larger social system in which an individual is embedded (e.g., group or social network), and not the individual itself, should be the unit of analysis when studying social processes. Because Moreno characterized individuals as "social atoms", sociometric methods have focused on assessing the positive and negative links between persons within a group, often characterized by "attractions" and "repulsions". Much of Moreno's work focused on understanding these forces, and translated attractions into "acceptance" and repulsions into "rejection." More recently, peer rejection has been conceptualized as social incompetence, and peer acceptance as social competence (e.g., Hartup, 1983).

Sociometric methods have related the properties of peer ecologies to academic success and failure (Moreno, 1934). The basic principle of these methods is that every member in a group has the capacity to evaluate every other group member on one or more criteria in a round-robin design. Variations of this design have depended on (1) whether one chose to use peer nominations, ratings, or paired comparisons, (2) the criteria used to assess attraction (e.g., "Who do you want to work with?" vs. "Who do you want to play with?"), (3) the decision to use

positive items only or to use positive and negative items (e.g., "most liked" and "least liked"), and (4) how to best quantify the scored derived from a sociometric test (Cillessen, 2009). Additionally, Cillessen and Bukowski (2000) pointed to three major events in the history of sociometric methods for the study of peer relations: (1) the change from one-dimensional to two-dimensional systems (e.g., use of both positive and negative nominations), (2) the introduction of social impact in addition to social preference, and (3) the identification of the five sociometric status groups (popular, rejected, neglected, controversial, and average). Peer relations can be conceptualized at three levels of social complexity: individual, dyad, and group (Cillessen, 2009). Individual status is not independent of the group, and thus, sociometric status represents the relationship between an individual and the group (Coie & Cillessen, 1993).

There are several procedures for conducting sociometric methods within an educational context. The basic consensus on such procedures has been established by researchers such as Coie, Dodge, and Copotelli (1982) as well as Newcomb and Bukowski (1983, 1984), who specified a method of collecting sociometric data in classrooms, as opposed to entire grades. The Coie et al. (1982) procedure had children name three classroom peers they liked most and three they liked least. They used decision rules to assign each child to one of the aforementioned five sociometric status groups. Newcomb and Bukowski (1983, 1984) modified this procedure by measuring three "best friend" nominations rather than "liked most" but also assigned children to one of the five status groups.

From the foundational classroom sociometric methods, the basic elements of a sociometric procedure are distinguished: reference group, voter population, "votee" population, sociometric criteria, data collection method, quantification method, method of standardization, sociometric dimensions, and classification method (Cillessen, 2009). The reference group is the

collection of persons (group or social network) within which status is determined, often the classroom or grade. The voter population comprises the children who participate as evaluators in a sociometric test. The votee population comprises children who are being evaluated. Ideally, all members of the reference group participate as both voters and votees. The sociometric criteria are the questions making up a sociometric test. Moreno (1934) distinguished two types of questions: emotional (subjective and personal to the voter) or reputational (perceived reputations rather than personal evaluations) (Moreno, 1934). An "emotional criteria" question might ask the voter to rate the peers they like most and least in the classroom, whereas a "reputational criteria" question might ask the voter to nominate peers who start fights or share.

The three methods of sociometric data collection are: peer nominations, peer ratings, and paired comparisons. Collecting peer nominations is the most commonly used method, and the one used for this dissertation study. Therefore, the following section will focus on describing only this method. One of the issues to consider with regard to this method is whether to collect limited or unlimited nominations. Because Coie et al. (1982) and Newcomb and Bukowski (1983) used three nominations, this number has often been used in studies using limited nominations. It may be more ecologically valid to allow students to nominate as many or as few students as they choose, but in studies with elementary school children and the classroom as the reference, the correlation between sociometric scores derived from limited and unlimited nominations is expected to be high (Cillessen, 2009). Another issue to consider is when to collect data. The common belief is that data collected at the beginning of the school year may be less stable than data collected at the end of the school year. Thus, it appears more effective to collect sociometric data in the middle or end of the school year, when students have been together for a large portion of the year and presumably know each other well (Cillessen, 2009).

Ethical Concerns

A variety of concerns come into play with regard to sociometric research. The main issue is that asking students to evaluate each other—either positively or negatively—is often a concern for parents and teachers. Particularly, having children nominate the "least liked" students in the classroom may reinforce particular negative beliefs children have about their classmates. As a result, researchers take steps to minimize any negative consequences, such as explaining and emphasizing confidentiality, using code numbers instead of names, and creating an atmosphere of respect for privacy in the classroom (Cillessen, 2009). Because the judgments children make in these studies is not very different from their judgments of their peers on a typical school day, the number of problems in sociometric studies is typically small.

The Present Studies

As is clear from the preceding literature review, there are several open questions about the connection between self-regulation and peer relationships in the classroom context, as well as teacher-decision making processes both influence and are influenced by students. There are several interrelated theories of self-regulation, peer relationships, and teaching strategies within the fields of education and psychology. Each of the concepts presented here have been extensively researched and developed, but ultimately, must inform methods that would be applicable in real-life classroom contexts. Thus, this research aims to capture a variety of phenomena occurring within the classroom setting in order to gain a more accurate understanding of how these processes influence child development. In addition to providing strong frameworks on these various concepts, the previous research on these topics has allowed for the adoption of certain conceptualizations in favor of others and to focus on where research is most needed. Self-regulation research, despite its varying definitions, is increasingly

incorporating motivation and creating a more accurate depiction of what children bring to the schooling experience that influences their development. Research must continue to understand how these individual characteristics are constantly interacting in a dynamic way in order to shape children's resulting developmental and academic outcomes. As mentioned in Chapter 1, the concept of co-regulation in early childhood is a relatively nascent yet increasingly studied topic, and this set of studies aims to contribute to the literature on the development of children's co-regulation skills within the classroom as they enter formal schooling. Incorporating the literature on peer networks is another logical step, and crucial to continue advancing this research if researchers and educators are to truly understand and learn from the complex world that is the classroom environment. Finally, including the teacher perspective provides us with a new understanding of how educators both affect and are affected by their students. The model below depicts the primary concepts examined within this study (see Figure 2.5). It depicts all relationships as bi-directional in nature, in that each concept both influences and is influenced by the others. For example, the model posits that peer relationships influence how children work together and co-regulate during a group activity, and peer relationships can be altered on the basis of how children interact with one another during group activities. In addition, teacher decisions shape peer relationships (e.g., Gest and Rodkin, 2011) and teachers make decisions based on the peer relationships they see forming in their classrooms.

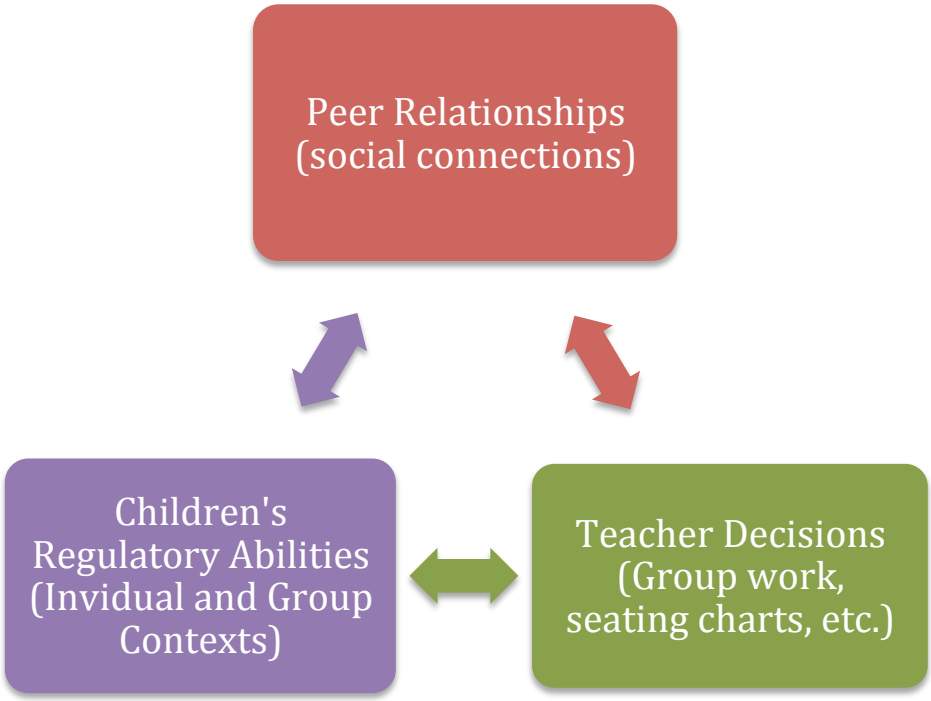

Figure 2.5. Proposed relations between peer relationships, co-regulation, and teacher decisions.

The three studies of this dissertation focused on connecting the three primary areas of interest illustrated in Figure 2.5. Study 1 examined peer network influences on self-regulation task performance. I investigated the differences between individual and group performance on an established self-regulation task. Studies 1 and 2 used identical grouping designs in order to maintain consistency. By contrast, Study 3 examined teachers' perspectives on classroom peer connections as well as decision-making with regard to grouping students (e.g., seating chart).

Study 1 has several implications for measurement of self-regulation in a classroom context. Although assessing individual students is the typically used methodology, there is a more recent emphasis on adapting measures previously used with individuals to a group context (e.g., McCabe & Brooks-Gunn, 2007). An important phenomenon driving Study 1 is the idea that children may exhibit one behavior (e.g., self-regulation) in a one-on-one context with an adult, but may not exhibit such behaviors in a peer group context. Oftentimes, the peer group

context can act as a distractor for children regardless of their regulatory abilities. Previous research (e.g., McCabe & Brooks-Gunn, 2007) has suggested that children perform worse on a self-regulation task in a group setting than on the same task in an individual setting. In addition to the primary research questions (see Chapter 1), I hoped to, at the very least, see if using a different measure of self-regulation would replicate these findings.

Study 2 moves beyond comparing individual to group performance on an established measure of self-regulation to examining specific, co-regulating behaviors that children exhibit while working on a collaborative problem-solving activity in pairs. In other words, it will focus on how children regulate *each other* in order to reach a particular goal rather than simply regulate themselves in the presence of other peers. Of the studies within this dissertation, the theoretical as well as practical need is especially strong for this paper. Establishing systematic, empirically-driven methods to understand the ways in which peer connections influence the development of children's co-regulation in the early grades is crucial for researchers and educators alike. The aforementioned studies (e.g., by Whitebread and colleagues) have already established an important precedent for systematically coding videos of young children working on genuine, grade-appropriate tasks that require the exchange of thoughts and ideas in order to reach a goal. Additionally, research has shown the advantages of naturalistic studies where children have a clear sense of purpose in relation to the tasks in which they are asked to engage (e.g., Istomina, 1975).

Study 3 focuses on obtaining kindergarten teachers' perspectives on both 1) classroom peer networks and 2) children's regulatory abilities. Essentially, this study will examine relations between teacher decisions to the other two concepts in Figure 2.5. In order to understand the

ways in which the classroom environment affects student learning, we examined whether and how teachers understand and make explicit decisions that impact their classroom peer ecologies.

Study 3 used an adapted questionnaire from Gest and Rodkin (2011) in order to understand teacher decision-making around seating arrangements in the classroom. I embedded this measure within a qualitative survey to help illuminate more nuances of teachers' thinking on their decisions as well as student behaviors indicative of self-regulation and co-regulation (e.g., during group work). Further, the survey asked teachers questions regarding their understanding of peer networks within their own classrooms. Acquiring the teacher perspective on these classroom phenomena provides researchers a much-needed sense of how practitioners connect their own personal observations about their students to actual decisions that impact those students. Finally, I aimed to determine whether teachers have specific systems for obtaining information on student peer networks and group-work tendencies and if so, what those looked like. If teachers did not have a way of systematically gathering such information, I hoped to understand whether they would find such methods useful or even feasible to add as part of their already loaded daily schedules. As mentioned previously, a crucial component of making substantial progress with research on this topic is the effective collaboration between educators and researchers. This will be a recurring theme throughout the dissertation, and each study was designed with this core goal in mind. Although the three studies provide their own unique insights into student and teacher classroom phenomena, it was my intention that they represent an attempt to strengthen the bridge between research in the field of educational psychology and real-world pedagogical practice.

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CHAPTER THREE

Study 1: Examining Individual and Group Performance on a Self-Regulation Assessment

Introduction

As described in Chapter 2, adult observations of children in the classroom setting often include instances of children acting in a more controlled manner in a one-on-one scenario with an adult (e.g., during a reading assessment) than with peers (e.g., working at a table cluster). While this is certainly not the case for every child, it is not unheard of for a parent to express the sentiment, "that's not how [child] acts at home" to a teacher who explains a child's disruptive classroom behavior, or for a teacher to note how a student "acts completely different when I'm working alone with them." As a result of these anecdotal observations, I investigated these phenomena in a more systematic, controlled manner to provide both researchers and educators with more information on what factors might influence a potential shift in regulatory ability from individual to group settings. Thus, the over-arching purpose of this study was to compare children's performance on an individual assessment of self-regulation (S-R) with performance on the same assessment while paired with another child. As discussed in Chapter 2, while there is a precedent for comparing children's performance on individual measures of self-regulation to their performance in a group context on motor control and delay of gratification tasks (McCabe & Brooks-Gunn, 2007), there is a lack of understanding of young children's group dynamics and how they impact specific regulatory outcomes, particularly on tasks of executive functions. To address this, the current study pairs students based on two factors that are believed to have an

impact on children's regulatory skills when in a social context: 1) their *peer status* (whether students were friends or non-friends according to the teacher's responses) and 2) *individual regulatory skill level* (whether students performed higher or lower on the individual self-regulation assessment relative to the median score for their class and gender; see Table 3.1 for pairing design).[1] In this study, regulatory skill level was defined as executive function skill level (comprised of children's individual attention, working memory, and inhibitory control abilities; see Chapter 2), and was measured using an established and validated behavioral regulation instrument called the Head-Toes-Knees-Shoulders task. The measure is typically associated with both reading and math outcomes for children (McClelland et al., 2007). Although recent evidence has indicated executive function assessments such as the HTKS task may relate more to math than reading, evidence for this claim is limited (Jacob & Parkinson, 2015). This measure is described in more detail in the following section.

Table 3.1. Pairing design with distributions of each pair type in the study.

Self-Regulation (Ind.)	*Friendship status*	*Gender*	*Number of pairs*
low-low pair	friends	male pair	3
		female pair	2
	non-friends	male pair	6
		female pair	5
low-high pair	friends	male pair	8
		female pair	4
	non-friends	male pair	8
		female pair	6
high-high pair	friends	male pair	7
		female pair	7
	non-friends	male pair	5
		female pair	7

[1] A Chi-square goodness-of-fit test determined that students were distributed evenly into 'friend' and 'non-friend' pairs ($\chi^2 = 1.88$, $p = .17$), but not into Low/Low, Low/High, High/Low, and High/High pairs ($\chi^2 = 16.00$, $p = .001$). This result is largely due to the fact that finding children who scored "low" relative to their classmates was difficult in the sample. Thus, creating "High/High" partnerships was simple, and creating enough "Low/Low", "Low/High", and "High/Low" pairings to fill each cell of the design proved to be more difficult. However, Chi-square analysis determined that students were distributed evenly across both pair type and gender ($\chi^2 = 3.61$, $p = .31$).

It is important to note that all students had already completed the HTKS task individually; therefore, I expected practice effects to be a limitation. However, as part of the study design, each child's individual HTKS score was required in order to determine how they related to the rest of the class scores and pair students accordingly. The methodological implications of this decision will be discussed later in this chapter.

The primary research questions for this study were:

- Controlling for individual self-regulatory skills, what is the relation between children's peer networks (patterns of liking) and their self-regulation while in a group context? Specifically, does performance on the Head-Toes-Knees-Shoulders task in a group context significantly differ as a function of whether a child's partner is a friend?
- Similarly, does performance on the HTKS task in a group context significantly differ as a function of children's individual HTKS scores?
    - Is the number of cued trials (amount of times children looked at a partner) during the paired HTKS task impacted by peer status or pair type?
- Does paired HTKS score predict academic achievement above and beyond individual HTKS score?

Hypotheses

As mentioned previously, the Head-Toes-Knees-Shoulders task had not been previously used with more than one child. However, other work has shown that young children's performance decreases from an individual to a group setting (e.g., McCabe & Brooks-Gunn, 2007). Because of its close connection with the current methodology, this study represents a foundation for my hypotheses in the current study. Based on this work, I did not necessarily predict a decrease in performance, but rather I expected that across all conditions, children would

not show a significant increase in HTKS performance from the individual to the paired contexts. However, I believed that children's individual regulatory skills would help differentiate performance between groups; specifically, that Low/Low pairs would show the lowest performance on the paired HTKS task, then Low/High pairs, and finally High/High pairs. I had no predictions about whether friendship between the students would impact performance on the paired HTKS assessment, but I suspected that friend pairs would perform worse than non-friend pairs due to the familiarity between the two becoming a distracting element during the task. This hypothesis is also based on work connecting sociability to less social inhibition (Caspi & Shiner, 2006). The idea that friends may be less socially inhibited suggests they may also be less behaviorally inhibited and could produce quicker responses to the HTKS commands that may prove distracting to their peers (particularly for low-regulated partnerships). Finally, I predicted that Low-regulated students would, overall, show more cued trials than High-regulated students, and that friends would show more cued trials than non-friends. Again, low-regulated students would likely look to a partner more often due to the difficulty of the task itself, and friends would likely be more comfortable looking to their partner for help than non-friends.

Method

Participants

Participants included 151 children from 11 Kindergarten classrooms within four different schools in southeastern Michigan. We recruited participants by sending home brief letters to parents from teachers introducing the researchers, describing the study, and endorsing the project, along with consent forms to sign and return. The children's ages ranged from 64.7 months (5 yr., 5 mo.) to 86 months (7 yr., 2 mo.). The mean age of all participants was 73.1 months (6 yr., 1 mo.; $SD = 4.1$). One child was unable to fully complete the individual assessments and was not

included in the final analyses. The sample was 54% male and 88% Caucasian. Mother's education level was used a proxy measure of socioeconomic status, and approximately 66% of the mothers of children in the sample had attained a bachelor's degree. Because some classrooms had odd numbers of consenting students, not all children could be placed in pairs, although all possible individual data was collected. Thus, the final number of participants in the paired activities was 136 (37 boy pairs, 31 girl pairs).

Procedure

Each classroom was visited twice from March to May of 2014. During the first visit, children were assessed individually on several measures (see below). These measures were counterbalanced so that all children did not complete the assessments in the same order. Also during the first visit, I asked teachers to complete a *peer status* sheet (see Appendix A), as well as two teacher-rating measures for each child in the study. In the time between visits, I used individual assessment data from the first visit to systematically match children in order to complete the paired activities during the second visit. Specifically, I created pairs where partners were either friends or non-friends (according to the classroom teacher's nominations) and either homogenous (Low/Low or High/High) or heterogeneous (Low/High). Pairs remained homogenous with regard to gender. I returned to each classroom approximately a week later to complete the paired HTKS task.

Measures

Achievement. Children completed the Woodcock-Johnson III Tests of Cognitive Abilities, Letter-Word Identification and Applied Problems subtests (Woodcock, McGrew, & Mather, 2001). These provided an assessment of letter and word reading and mathematical problem

solving, respectively. Additionally, teachers completed the Academic and Social Competence scale (Valeski & Stipek, 2001), which asks teachers to rate the child's reading, math, and social competence on a scale from 1 to 5. Table 3.2 presents the teacher rating scale reliabilities, and the scale items are in Appendix B.

Table 3.2. Cronbach's α reliability scores for academic and social competence scales.

Scale	Reliability (α)
Reading	.96
Math	.93
Social Skills	.92

Self-regulation. Children completed the Head-Toes-Knees-Shoulders task (HTKS; Ponitz, McClelland, Matthews, & Morrison, 2009). This measure of behavioral self-regulation has children perform the opposite of the experimenter's commands (directions include, "When I say, 'Touch your toes,' you touch your head!"; see Appendix C). For each trial, children are given a score of 0 (incorrect response), 1 (child self-corrects), or 2 (correct response). The assessment includes three parts, each with 10 trials. Part 1 had children respond to commands involving only "head" and "toes." Part 2 added "knees" and shoulders" in order to increase difficulty. Finally, Part 3 switched the pairing from Parts 1 and 2 (head with knees, toes with shoulders). Part 3 is not assessed if children do not score at least five correct trials (including self-correct responses) on part 2. In this study, the vast majority of students made it to Part 3. Connor et al. (2007) report interrater reliability for the Head-to-Toes short version of this measure to be 0.95. Ponitz et al. (2009), report 75% consistency across examiners scoring HTKS.

Each child was assessed individually during the first visit, and the majority of children completed the task again with a partner during the second visit, depending on the number of consented children in the classroom. For the paired version of HTKS, the directions remained exactly the same as in the individual version. Children were given no instructions about how to stand after being initially told to stand in their spot, as well as no restrictions on being able to look to their partner for a correct response. Children stood approximately two feet apart and faced the experimenter.

In order to compare raw individual and paired HTKS scores, paired HTKS assessments were initially scored in the same way as the individual assessment (0-2 scale). However, scoring was also modified for the paired HTKS to determine if this would be a feasible change to the assessment in order to use it to assess multiple students in future studies. The modification was warranted because within the group dynamic, we frequently saw children looking to their partner for the correct response to each command both before and after their own response. Thus, we included "cued responses" as part of the modified scoring system:

0 – *Incorrect response* (e.g., child touches any part other than the opposite one they are supposed to; ex. says 'touch your head' and child touches their head)

1 – *Self-correct, cued* (child self-corrects but only after looking at another student; oftentimes, their partner may self-correct first, prompting them to do the same)

2 – *Correct, cued* (child responds correctly, but only after looking at their partner's cue; e.g., child may hesitate to respond, then do so only after looking at their partner)

3 – *Self-correct, not cued* (child self-corrects on their own, not looking at their partner for any cues; oftentimes, they will be the first in the pair to self-correct)

4 – *Correct, not cued* (child responds correctly on their own, not looking at their partner for any cues; e.g., ex. says 'touch your head' and child touches their toes with no cue from partner)

Additionally, we coded for an "incorrect self-correct" response, in which a child initially responded correctly, and then switched to an incorrect response on their own, as well as a "incorrect self-correct, cued" response in which a child initially responded correctly, and switched to an incorrect response as a result of looking at their partner's incorrect response. These instances were extremely rare across all trials, and thus, were not included in the final analyses. Table 3.3 presents the inter-rater reliability data on paired HTKS variables coded from video. See Appendix C for the full administration instructions.

Table 3.3. Inter-rater reliability for paired self-regulation coding.

Variable	Interrater Reliability (ICC)
Paired HTKS Score (Part 1)	.87
Paired HTKS Score (Part 2)	.93
Paired HTKS Score (Part 3)	.95
Paired HTKS Score (Total)	.95
Cued Trials (Total)	.84

Teacher report. Teachers rated children's self-regulation on a measure developed by Lan (2009) (see Appendix D). This scale asks teachers to rate children on items such as "Follows two-step directions" and "Has a short attention span" on a scale from 1-7, and typically yields three factors: response inhibition, working memory, and attention control. See Table 3.4 for scale reliability data.

Table 3.4. Cronbach's α reliability scores for teacher-rated self-regulation scales.

Scale	Reliability (α)
Self-regulation (all)	.94
Inhibitory Control	.93
Attention	.83
Working Memory	.80

Results

Table 3.5 presents descriptive results of achievement, self-regulation, and teacher-rating variables. For the Head-Toes-Knees-Shoulders task, data are provided for parts 1, 2, and 3 of both the individual and paired assessments. Because paired HTKS assessments were scored in both the standard (0-2) format and modified (0-4) format, data are provided for each. All measures yielded adequate variability for analysis.

Table 3.5. Descriptive statistics for academic achievement and regulation variables.

Variable	Range	Mean (SD)
WJ Letter-Word Identification	12-52	24.82 (6.94)
WJ Applied Problems	9-29	22.15 (3.23)
HTKS Part 1 (Individual)	0-20	17.26 (4.08)
HTKS Part 2 (Individual)	0-20	15.20 (4.77)
HTKS Part 3 (Individual)	0-20	8.75 (6.75)
HTKS Total (Individual)	0-59	41.17 (12.91)
HTKS Part 1 (Standard, Paired)	8-20	18.67 (1.72)
HTKS Part 2 (Standard, Paired)	4-20	16.55 (2.98)
HTKS Part 3 (Standard, Paired)	0-20	11.43 (5.08)
HTKS Total (Standard, Paired)	13-60	46.61 (7.78)
HTKS Part 1 (Modified, Paired)	8-40	35.56 (5.15)
HTKS Part 2 (Modified, Paired)	6-40	30.11 (7.95)
HTKS Part 3 (Modified, Paired)	0-40	19.78 (9.82)
HTKS Total (Modified, Paired)	17-118	85.40 (18.28)
Teacher-Rated Response Inhibition	1.40-7	5.12 (1.37)
Teacher-Rated Attention	1-7	4.46 (1.56)
Teacher-Rated Working Memory	3-7	5.74 (.88)
Teacher-Rated Reading	1-5	3.23 (.97)
Teacher-Rated Math	1-5	3.14 (.76)
Teacher-Rated Social Skills	2-5	3.03 (.61)

Note. N=150 for WJ-LW, WJ-AP, individual HTKS scores, and teacher-rated scores; N=136 for all paired HTKS scores.

Correlations

Before examining the research questions regarding how children performed on the Head-Toes-Knees-Shoulders task individually relative to how they performed in pairs, I first wanted to establish the relations between academic achievement and HTKS scores, both individual and in pairs using partial correlations, controlling for gender and age. First, Table 3.6 shows correlations between individual HTKS scores and academic achievement. Second, Table 3.7 shows correlations between academic achievement and paired HTKS scores (standard scoring), while Table 3.8 shows correlations between academic achievement and paired HTKS scores (modified scoring).

Table 3.6. Correlations between individual HTKS variables and achievement variables.

	WJ-LW	WJ-AP	TR-Read	TR-Math	TR-Social	HTKS (Part 1)	HTKS (Part 2)	HTKS (Part 3)	HTKS (Total)
WJ-LW	--								
WJ-AP	.53***	--							
TR-Read	.60***	.37***	--						
TR-Math	.59***	.43***	.80***	--					
TR-Soc.	.17*	.25**	.37***	.38***	--				
HTKS (Part 1)	.19*	.43***	.14^{t}	.15^{t}	.15^{t}	--			
HTKS (Part 2)	.22**	.40***	.27**	.22**	.23**	.73***	--		
HTKS (Part 3)	.04	.22**	.13	.13	.21*	.43***	.51***	--	
HTKS (Total)	.16^{t}	.40***	.21**	.19*	.24**	.81***	.86***	.84***	--

Note. N=144; ^{t} $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. 1) WJ-LW = Woodcock-Johnson Letter Word Identification, 2) WJ-AP = Woodcock-Johnson Applied Problems, 3) TR-Read = teacher-rated reading competency, 4) TR-Math = teacher-rated math competency, 5) TR-Social = teacher-rated social skills, 6) HTKS = Head-Toes-Knees-Shoulders.

When examining correlations between individual HTKS scores and academic achievement variables, several significant relations stand out. As has been previously established, there is a significant correlation between the Woodcock-Johnson Applied Problems scores and total HTKS score ($r = .40$, $p < .001$). However, the correlation between Woodcock-Johnson Letter Word Identification scores and total HTKS score was not significant ($r = .16$, $p < .10$). A Fisher r-to-z transformation calculation confirmed that the two correlation coefficients significantly differ from one another ($z = -2.20$, $p < .05$). This supports previous research suggesting that the HTKS measure is more closely associated with math performance than reading performance, and that the HTKS assessment may tap into skills more typically used when solving math problems (e.g., working memory). Total individual HTKS score also had a significant positive relation to teacher-rated reading competence ($r = .21$, $p < .01$), math competence ($r = .19$, $p < .05$), and social competence ($r = .24$, $p < .01$). Also notable is the trend that performance on Part 3 of the HTKS task seems unrelated to W-J Letter Word scores, whereas Parts 1 and 2 are. Additionally, Part 3 is still significantly correlated with W-J Applied Problems, albeit less so than Parts 1 and 2. With regard to teacher-rated academic competence variables, Part 3 of the HTKS task only shows a relation with teacher-rated social competence ($r = .21$, $p < .05$), but not with teacher-rated math or reading competence. Due to the lack of any discernible pattern in relations between each of the three individual parts of the HTKS task and academic achievement variables, I chose to focus only on the total HTKS scores for the remaining analyses.

Table 3.7 shows correlations between the paired HTKS scores, using the standard 0 – *incorrect response*, 1 – self-correct, and 2 – *correct response* scoring system, and the academic achievement variables. This method also includes a variable for "cued trials", or instances in

which a child looked to their partner either prior to responding, or after responding initially but before a 'self-correct' response. Table 3.8 shows correlations between the paired HTKS scores, using the modified (0 – incorrect response, 1 – cued self-correct, 2 – self-correct, not cued, 3 – cued correct, and 4 – correct, not cued) scoring system, and the academic achievement variables. While the modified scoring method was created to account for the cued responses that occurred within the paired HTKS trials, it is useful to look at how each scoring system relates to academic achievement variables, particularly in treating cued trials as a separate variable.

Table 3.7. Correlations between paired HTKS variables (0-2 scoring) and achievement variables.

	St. HTKS (Part 1)	St. HTKS (Part 2)	St. HTKS (Part 3)	St. HTKS (Total)	Cued Trials
WJ-LW	.25**	.23**	.23**	.29**	-.14
WJ-AP	.47**	.45**	.19*	.40*	-.22*
TR-Read	.15^{t}	.21*	.30**	.30**	-.27**
TR-Math	.19*	.26**	.24**	.30**	-.31***
TR-Soc.	.11	.10	.26**	.23*	-.22**

Note. N=125; ^{t} $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3.8. Correlations between paired HTKS variables (0-4 scoring) and achievement variables.

	Mod. HTKS (Part 1)	Mod. HTKS (Part 2)	Mod. HTKS (Part 3)	Mod. HTKS (Total)
WJ-LW	.21*	.28**	.25**	.31***
WJ-AP	.43***	.44***	.25***	.45***
TR-Read	.15^{t}	.34***	.37***	.39***
TR-Math	.17^{t}	.38***	.32***	.38***
TR-Soc.	.13	.25**	.28**	.30**

Note: N=125; ^{t} $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

First, when comparing the correlations between total individual HTKS score and academic achievement in Table 3.6 to correlations for the same variables in Table 3.7, several differences emerge. First, as mentioned previously, although the total individual HTKS scores were not significantly correlated with W-J Letter Word scores ($r = .16$, $p < .10$), total standard paired HTKS scores were significantly correlated with W-J Letter Word scores ($r = .29$, $p < .01$). Interestingly, as with the correlation between individual HTKS and W-J Applied Problems, standard paired HTKS score was correlated with W-J AP scores with a coefficient of .40. With regard to teacher rated variables, total standard paired HTKS scores showed a stronger correlation for teacher-rated reading competence ($r = .30$, $p < .01$), and teacher-rated math competence ($r = .30$, $p < .01$), whereas the correlation with teacher-rated social competence was approximately the same ($r = .23$, $p < .05$).

When comparing the Table 3.7 (standard paired HTKS scoring) and 3.8 (modified paired HTKS scoring), several relations stand out. For all five academic achievement variables, the correlations with the total paired HTKS score are slightly stronger using the modified scoring system. The largest difference appears to be the correlation between total paired HTKS score and teacher-rated reading ability (standard score: $r = .30$, $p < .01$; modified score: $r = .39$, $p < .001$). Regardless of the scoring system used for the paired HTKS trials, the increase in strength of the correlation coefficients from individual HTKS to paired HTKS helps address whether how children perform on the same activity or assessment in a peer context might have a stronger association with academic achievement and teacher-rated competence, as opposed to how children perform in a one-on-one scenario with an adult. This question will be discussed later in the chapter.

With regard to children's scores on each of the three individual parts of the HTKS, there were no discernible patterns of relations between Part 1, 2, or 3 HTKS scores and academic achievement variables, except that Part 2 HTKS scores (when children paired 'head with toes' and 'knees with shoulders') were significantly positively correlated with each of the academic achievement variables, whereas relations between Parts 1 ('head with toes') and 3 ('head with knees' and 'shoulders with toes') and achievement showed varying degrees of significance. Because of this, I simply chose to focus on the total HTKS scores (both individual and paired) when addressing the primary research questions, rather than the individual parts of the assessment.

Main Effect of Peer Status on Paired HTKS Variables

After establishing the relations between individual HTKS scores, paired HTKS scores, and academic achievement variables, I now turn toward addressing the primary research questions. To focus on the first question of whether friendship status within a pair impacted how children performed during the paired HTKS task, outcomes of interest must be defined. One outcome is the change in performance from individual to paired HTKS trials, and whether friend and non-friend pairs differed on this variable. For this, I calculated a difference variable for each child, subtracting the total score on the individual HTKS trials from the total score on the paired HTKS trials, using the standard (0-2) scoring system (M = 5.68, SD = 10.86), to be discussed subsequently. A second outcome is children's individual performance on the paired (standard scoring) HTKS task, and whether being in a friend or non-friend pair significantly impacted this variable. Finally, the number of cued trials occurring within the paired HTKS assessment is another outcome of interest, due to it being a behavioral phenomenon unique to the paired HTKS trials.

In order to first determine whether there was a significant difference in scores for students from the individual HTKS assessment to the paired HTKS assessment, I ran a repeated measures t-test, using individual HTKS as the 'pretest' and paired HTKS as the 'posttest' to determine whether students, on average, increased or decreased in total HTKS score from the individual assessment to the paired assessment. Results showed that for all students, there was a significant mean increase in scores from individual (M = 40.93, SD = 13.98) to paired (M = 46.61, SD = 7.78) HTKS trials (df = 135, $p < .001$). For girls, the difference between individual (M = 41.60, SD = 13.18) to paired (M = 48.16, SD = 6.38) was significant (N = 62, $p < .001$). For boys, the difference between individual (M = 40.36, SD = 13.42) to paired (M = 45.31, SD = 6.38) was also significant (N = 74, $p < .001$). This established that, on average, students showed a significant increase in total HTKS score from when they were assessed individually to in a paired setting, contrary to my hypothesis. Of course, this result did not account for whether peer status within pairs may have influenced these score increases.

In order to determine whether there was a main effect of peer status on HTKS score change, paired (standard) HTKS score, or number of cued trials across all pairs in the sample, paired HTKS variables of interest were subjected to a 2 by 2 by 4 ANOVA design having two levels of gender (boy, girl), two levels of peer status (non-friend, friend) and four levels of regulation pair type (Low/Low, Low/High, High/Low, High/High. Paired (modified) HTKS score was not included in the analyses due to its high correlation with paired (standard) HTKS score. Additionally, the modified HTKS scoring system accounts for the number of cued trials, and I wanted to parse out cued trials from the score itself. ANOVA analyses showed no significant main effect of peer status on HTKS score change from the individual to paired setting, $F(1, 135) = 1.08$, $p = .30$, total paired HTKS score $F(1, 135) = .27$, $p = .61$, or cued trials $F(1,$

135) = .34, p = .56. Adjusted R-Squared values for each model were .35 for the HTKS difference score, .34 for the total (standard) paired HTKS score, and .07 for the cued trials, respectively. The results indicated that, across the sample, students paired with a friend and those paired with a non-friend did not significantly differ with regard to the paired HTKS variables of interest.

Main Effect of Regulatory Pair Type on Paired HTKS Variables

Tables 3.9 (all students), 3.10 (girls only), and 3.11 (boys only) show means and standard deviations for the paired HTKS variables of interest for each of the different regulatory pair types.

Table 3.9. Means and standard deviations of paired HTKS variables (all students).

Pair type	Paired HTKS (Standard 0-2 scoring)	Paired HTKS (Modified 0-4 scoring)	HTKS Difference (Ind. to Paired)	Cued Trials	N
Low/Low	39.50 (9.13)	72.80 (20.02)	11.93 (11.57)	5.53 (4.50)	30
Low/High	45.35 (5.65)	78.19 (15.16)	14.46 (11.79)	9.19 (6.44)	26
High/Low	48.23 (6.07)	93.85 (14.72)	-.65 (6.48)	3.46 (4.01)	26
High/High	50.39 (5.55)	91.81 (15.14)	1.04 (6.35)	6.57 (6.09)	54

Table 3.10. Means and standard deviations of paired HTKS variables (girls only).

Pair type	Paired HTKS (Standard 0-2 scoring)	Paired HTKS (Modified 0-4 scoring)	HTKS Difference (Ind. to Paired)	Cued Trials	N
Low/Low	42.92 (7.21)	78.00 (15.72)	18.42 (13.27)	5.92 (5.04)	12
Low/High	47.90 (5.82)	78.20 (14.45)	15.90 (12.14)	12.10 (4.91)	10
High/Low	51.10 (5.82)	99.50 (13.88)	1.10 (5.86)	2.70 (2.45)	10
High/High	49.37 (5.38)	89.50 (15.29)	.53 (6.33)	6.40 (5.80)	30

Table 3.11. Means and standard deviations of paired HTKS variables (boys only).

Pair type	Paired HTKS (Standard 0-2 scoring)	Paired HTKS (Modified 0-4 scoring)	HTKS Difference (Ind. to Paired)	Cued Trials	N
Low/Low	37.22 (9.74)	69.33 (22.18)	7.61 (8.07)	5.28 (4.24)	18
Low/High	43.75 (5.08)	78.19 (16.05)	13.56 (11.87)	7.38 (6.74)	16
High/Low	46.44 (5.68)	90.31 (14.52)	-1.75 (6.79)	3.94 (4.75)	16
High/High	51.67 (5.60)	94.71 (14.75)	1.67 (6.46)	6.79 (6.55)	24

After finding that peer status within groups did not appear to have a significant main effect on students' change in HTKS score from individual to paired assessments, their total paired HTKS scores, or the number of cued trials, I turned to address the second research question about whether comprising pairs based on individual children's HTKS abilities impacted how they performed on the paired HTKS assessment. As stated previously, I combined students into Low/Low, Low/High, and High/High groups. These groupings were determined by how children performed on the individual HTKS assessment relative to the median score for their gender within their class. The ramifications of this decision will be discussed subsequently. Using the individual child as the unit of analysis, the categorical variable "pair type" was coded so that the 'Low/High' heterogeneous group was treated as two separate groups, because in those particular pairs, the child occupied the unique role of either the "low" regulated or "high" regulated child. Thus, groups were coded as follows: 0 = *Low/Low (child was low regulated with a low regulated partner),* 1 = *Low/High (child was the lower regulated of the two),* 2 = *High/Low (child was the higher regulated of the two),* and 3 = *High/High (child was high regulated with a high regulated partner)*. These pair types will be referred to in this manner throughout the rest of the chapter.

In order to determine whether there was a main effect of regulatory pair type on students' HTKS difference score, total paired HTKS score, and number of cued trials, I examined the 2 by 2 by 4 (gender by peer status by regulatory pair type) ANOVA analyses discussed in the previous section. First, the main effect of regulatory pair type yielded an F ratio of $F(3, 135) = 12.79$, $p < .001$, indicating that the mean HTKS difference score, or the average increase from individual to paired contexts, was significantly different between regulatory pair types. A post hoc Tukey test revealed that students in Low/Low pairs did not significantly differ from those in

Low/High pairs with regard to their HTKS difference scores, but did significantly differ from students in High/Low and High/High pairs. Additionally, students' HTKS difference scores in Low/High pairs significantly differed from both High/Low and High/High pairs, indicating that, overall, low-regulated students' HTKS scores increased significantly more than those of high-regulated students from individual to paired assessments.

Second, the main effects of regulatory pair type on total paired HTKS scores were significant, $F(3, 135) = 14.92$, $p < .001$. This indicates that total paired HTKS score was significantly different between regulatory pair types. A post hoc Tukey test showed that when using the standard paired HTKS scoring, students in Low/Low pairs significantly differed with regard to their total paired HTKS scores from those in Low/High, High/Low, and High/High pairs. Students in Low/High pairs significantly differed from students in High/High pairs with regard to their total paired HTKS scores, but not students in High/Low pairs.

Finally, the results showed a significant main effect of regulatory pair type on the number of cued trials, $F(3, 135) = 5.10$, $p < .01$. A post hoc Tukey test showed that students in Low/Low pairs had fewer cued trials than students in Low/High pairs, but that this difference was not significant. Additionally, students in Low/High pairs showed significantly more cued trials than students in High/Low pairs. Finally, Students in High/Low pairs showed fewer cued trials than students in High/High pairs, but that this difference was also not significant (see Figure 3.1).

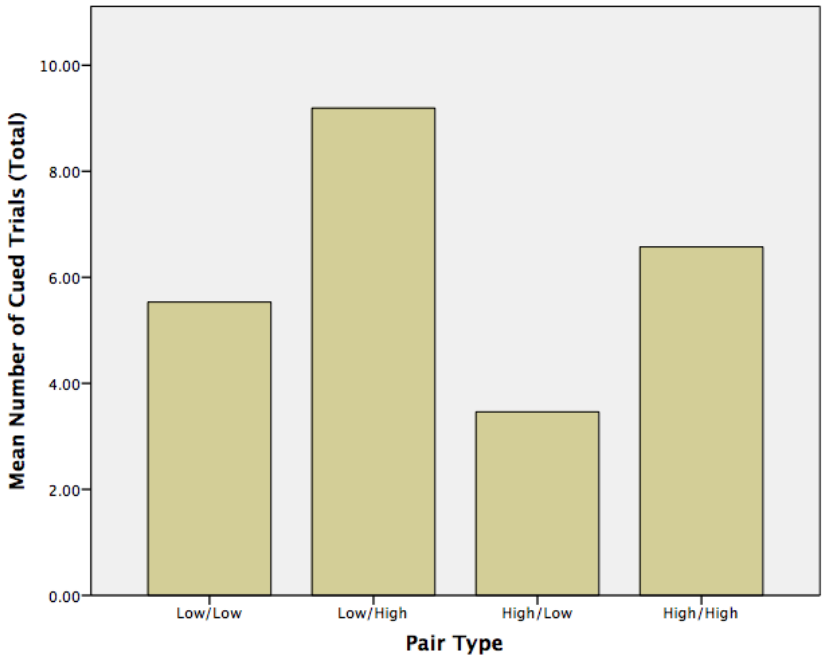

Figure 3.1. Main effect of regulatory pair type on number of cued trials.

Main Effect of Gender on Paired HTKS Variables

The results of the 2 by 2 by 4 ANOVA showed no main effects of gender on HTKS score difference, $F(1, 135) = 2.43$, $p = .12$, or cued trials, $F(1, 135) = .61$, $p = .44$. However, there was a main effect of gender on total paired HTKS score, $F(1, 135) = 7.68$, $p < .01$. These results indicated that, across the sample, boys and girls differed with regard to the total paired HTKS score, with girls scoring significantly higher on average ($M = 48.16$, $SD = 6.38$) than boys ($M = 45.31$, $SD = 8.61$).

Interaction Effects

The results of the ANOVA test showed a significant gender by regulatory pair type interaction effect on total paired HTKS score, $F(3, 135) = 3.75$, $p < .01$. Figure 3.2 depicts the interaction. Independent t-tests revealed that among students in Low/Low pairs, the group differences between boys and girls were not significant, $t(28) = -1.73$, p = .09. Among students

in Low/High pairs, the group differences between boys and girls were not significant, $t(24) = -1.92$, $p = .07$. Among students in High/Low pairs, the group differences between boys and girls were not significant, $t(24) = -2.02$, $p = .06$. In each of these three instances, girls scored higher than boys on the paired HTKS task. Finally, among students in High/High pairs, boys scored higher than girls on the paired HTKS task, although the group differences between boys and girls were not significant, $t(52) = 1.53$, $p = .13$.

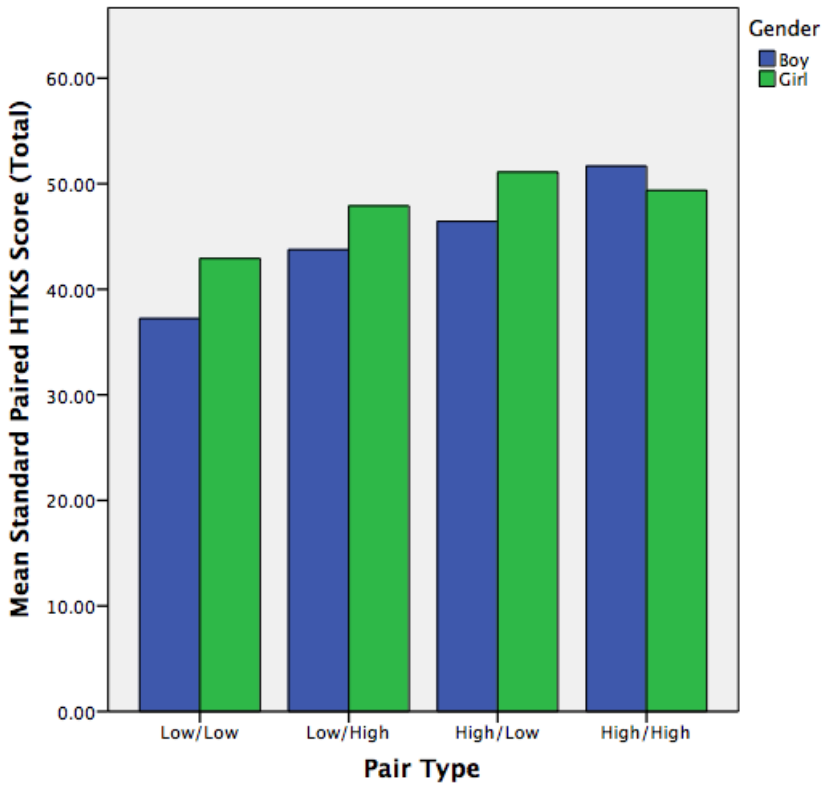

Figure 3.2. Pair type by gender interaction on mean paired HTKS score.

When examining further what may have influenced boys in every regulatory pair type, aside from High/High, to score lower than girls on the paired HTKS task, a 2 (peer status) by 4 (pair type) ANOVA analyses was conducted using only the boys in the sample. The results indicated that in addition to a main effect of regulatory pair type on paired HTKS performance, there was a significant peer status by pair type interaction effect, $F(3, 135) = 2.80$, $p < .05$. Figure 3.3 depicts the interaction for boys only. Among boys in Low/Low pairs, those paired with a friend scored significantly lower than those paired with a non-friend, $t(16) = 1.96$, $p < .05$.

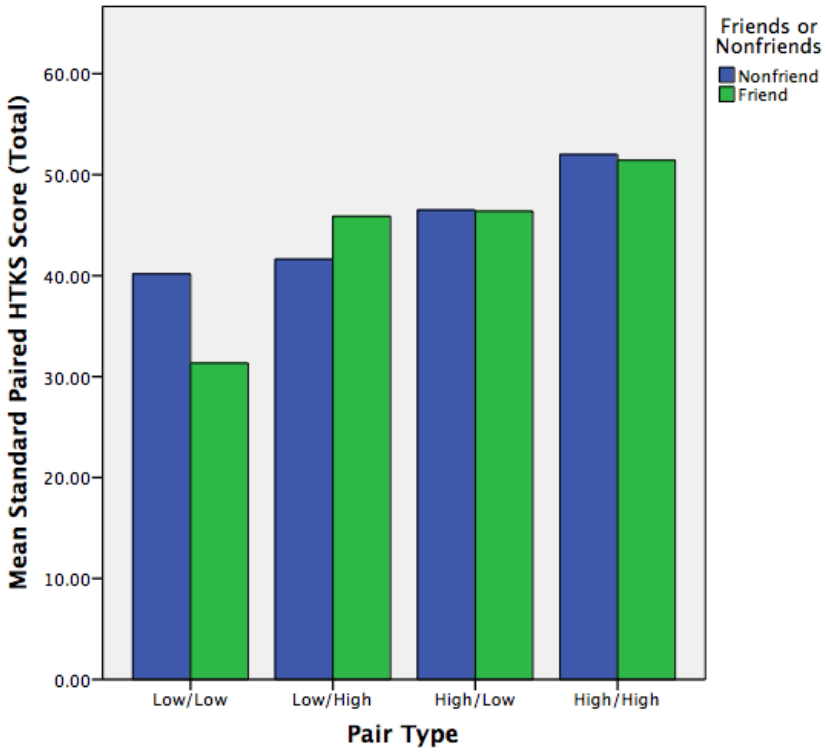

Figure 3.3. Pair type by peer status interaction effect on mean paired HTKS score (boys only).

After establishing the gender by pair type interaction effect for all students, as well as the peer status by pair type regulation pair type for boys on total (standard) HTKS score, I further investigated the previously mentioned main effect of pair type on group differences on the

number of cued trials that occurred within the paired HTKS assessment. As mentioned, the ANOVA analysis showed that there was a significant effect of regulatory pair type on the number of cued trials; however, the interaction was not significant, $F(3, 135) = 1.18$, $p = .32$). A Tukey test showed that only students in Low/High and High/Low pairs significantly differed on the number of cued trials. Although there was no significant peer status by pair type interaction effect for the cued trials variable, among High/Low pairs, the mean difference between friend and non-friend groups with regard to cued trials was significant, $t(24) = -3.131$, $p < .01$. There were no other significant group differences in any of the other pair types. When broken down by gender, this difference was significant for boys, $t(14) = -2.508$, $p = .025$ (see Figure 3.4), but not for girls.

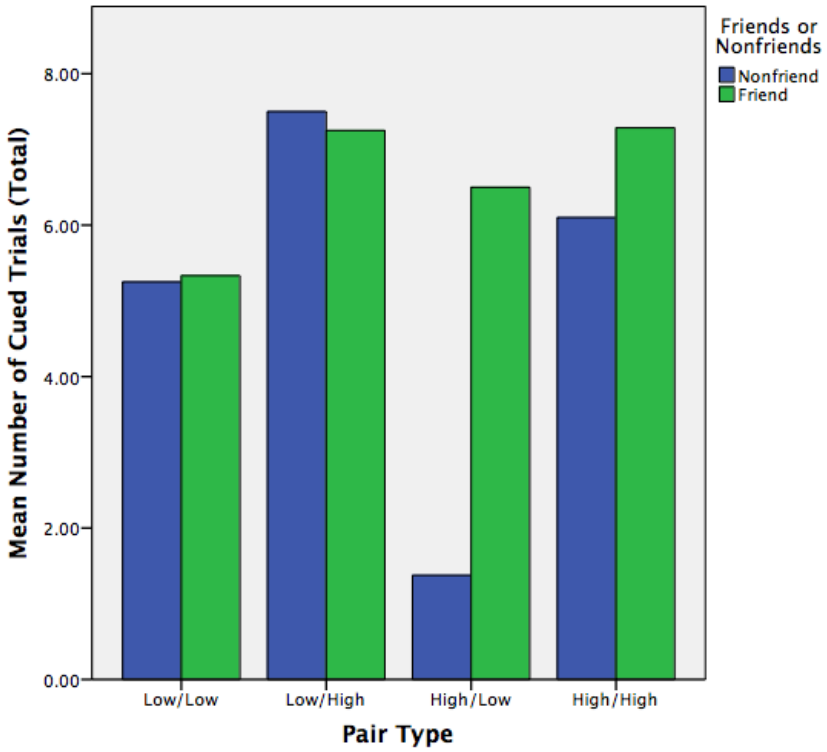

Figure 3.4. Graph showing group differences on number of cued trials (boys only).

Predictors of Academic Achievement

Although this chapter has focused on comparing children's performance on the same assessment of self-regulation in both individual and paired contexts, a primary goal of research on self-regulation in early childhood is to determine predictors of academic achievement. As mentioned, previous research (e.g., McClelland et al., 2007) has established connections between children's individual HTKS score and academic achievement. However, no study has addressed whether performance on the HTKS task in a paired context may be a better predictor of achievement in young children. To address the final research question of whether performance on the HTKS task in a paired context would have the same, or better, predictive power as performance on the HTKS task in an individual context, OLS linear regression models were used to determine which variables significantly predicted performance on the Woodcock-Johnson Letter Word Identification and Applied Problems subtests. Control variables such as gender, age, and mother's education level (proxy variable for socioeconomic status) were used, as well as individual and paired HTKS scores, and teacher-rated academic competency and regulation variables. Table. 3.12 presents the final model for W-J Letter Word and Applied Problems.

Table 3.12 shows that the final model accounted for 58% of the variation in reading scores, $F(12, 124) = 13.46$, $p < .001$. Of the control variables, only gender (standardized $\beta = .22$, $p < .01$) significantly predicted reading achievement. That is, girls tended to score higher on the reading assessment than boys. Math score was the strongest predictor of reading achievement, (standardized $\beta = .41$, $p < .001$). Among the teacher-rating variables, math competency positively predicted (standardized $\beta = .30$, $p < .01$) and attention negatively predicted reading achievement.

Conversely, the regression results showed a slightly different set of predictors for math achievement. Table 3.12 shows that the model accounted for 55% of the variation in math achievement, $F(12, 124 = 11.74, p < .001)$. Gender negatively predicted math achievement (standardized $\beta = -.25$, $p < .001$), indicating that girls showed lower math achievement than boys. Age was a positive predictor of math achievement (standardized $\beta = .16$, $p < .05$), as was reading achievement (standardized $\beta = .44$, $p < .001$). Finally, individual HTKS score was a positive predictor of math achievement (standardized $\beta = .18$, $p < .05$), but not paired HTKS score. None of the teacher-rating variables significantly predicted math achievement. Overall, the results support previous findings that links children's individual performance on the HTKS task with math achievement, but not reading achievement, though recent research has cautioned against making this claim (Jacobs & Parkinson, 2015). Additionally, the analyses suggest that paired HTKS score does not predict academic achievement above and beyond individual HTKS score. Potential reasons for this will be subsequently discussed.

Table 3.12. Predictors of academic achievement.

Variable	Final Model (*df*)	*β*	
W-J Letter Word Identification	$F(12, 124) = 13.46$***		Model $R^2 = .58$
Gender		.22**	
Age		-.05	
Mother Education Level		.11	
W-J Applied Problems		.41***	
HTKS Score (Individual)		-.12	
HTKS Score (Paired)		.11	
T-R Reading Competency		.20^{t}	
T-R Math Competency		.30**	
T-R Social Skills Competency		-.11	
T-R Inhibitory Control		.15	
T-R Attention		-.32**	
T-R Working Memory		.11	
W-J Applied Problems	$F(12, 124) = 11.74$***		Model $R^2 = .55$
Gender		-.25***	
Age		.16*	
Mother Education Level		.11	
W-J Letter Word Identification		.44***	
HTKS Score (Individual)		.18*	
HTKS Score (Paired)		.08	
T-R Reading Competency		-.11	
T-R Math Competency		.11	
T-R Social Skills Competency		.04	
T-R Inhibitory Control		.11	
T-R Attention		.04	
T-R Working Memory		.06	

Note. N = 136. ^{t} p < .10., * $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

The over-arching purpose of this study was to examine how children scored on the same Head-Toes-Knees-Shoulders self-regulation assessment in both a one-on-one context with an adult and a paired context with a classroom peer with whom they were strategically placed by the researcher. Specifically, the research questions addressed how two factors: 1) peer status, and 2) individual self-regulation ability influenced children's score during the paired assessment, as well as the number of cued trials each child had. Additionally, a goal of this study was to determine whether performance on the HTKS task in a paired context might be a predictor of academic achievement above and beyond performance on the same task in an individual setting. Finally, an informal aim of the study was to determine the feasibility and ecological validity of using the HTKS task to assess more than one child at a time. To my knowledge, this is the first study to use the HTKS task in order to assess multiple students simultaneously. Given the novelty of this method, its adaptation for use in this study merits discussion.

The results confirmed findings from previous studies that individual HTKS scores are not as strongly correlated with reading performance as they are with math performance. Partial correlations showed a non-significant correlation between individual HTKS scores and Woodcock-Johnson Letter Word Identification scores ($r = .16$, $p < .10$), whereas the relation between individual HTKS scores and the Applied Problems scores was significant and much stronger ($r = .40$, $p < .001$), a significant difference confirmed by the Fisher's r-to-z test. This finding reiterates the notion that executive function (EF) components measured in the Head-Toes-Knees-Shoulders task (e.g., inhibitory control, attention, working memory) may be more related to those skills required in math learning than for reading, although more recent research claims there is reason to question these relations (Jacob & Parkinson, 2015). Nonetheless, this

provided an important contrast when examining correlations between paired HTKS scores and academic achievement variables, discussed below. There were also modest positive correlations between individual HTKS scores and teacher-rated academic and social competence variables, indicating that higher self-regulation/EF skills are related to teachers' perceptions of student academic and social competence.

The Impact of Peer Status on Self-Regulation in a Group Context

To investigate the first research question, I first established that there was a significant difference in scores from the individual HTKS assessment and the paired assessment. Contrary to the hypothesis that children would perform worse on the paired HTKS task due to the distracting nature of a partner, children scored significantly higher on the paired HTKS task than on the individual task. I focused on this change in score from individual to paired assessment, by calculating a difference variable. Using peer status as a grouping variable showed no significant group differences in the HTKS difference score variable. That is, the mean increase in HTKS score from individual to paired assessment was not due to whether children were in a friend or non-friend pair. Additionally, there were no group differences between students in friend pairs or non-friend pairs with regard to the number of cued trials. Based on the overwhelming literature citing friends as supports as children transition to formal schooling, one of the hypotheses was that, regardless of gender, any increase in HTKS score from individual to paired setting would be influenced by students being paired with a friend, partly due to the possibility that they may be more comfortable looking to a friend for assistance when responding, thereby increasing the number of correct responses that would have otherwise been incorrect. Because the nature of the task did not provide any explicit instruction *against* looking to a partner for help, it seemed reasonable to expect that having a friend for a partner would facilitate more interaction (e.g.,

visual or verbal cues). However, it seemed that, by itself, peer status within a pair did not have a significant impact on the degree to which children increased their self-regulation score from an individual to a paired context, nor did it impact the number of cued trials during the assessment.

The Impact of Individual Regulatory Ability on Self-Regulation in a Group Context

The second primary research question from this study was whether children's individual self-regulatory abilities played a role in how they performed when paired with a partner who either had a high or low individual regulatory ability. Thus, part of the research design included determining whether children had a "high" or "low" level of regulatory ability. I chose to determine this based on how children's individual HTKS scores compared to the median score for their gender within their classroom, in order to account for between-class and between-school differences in regulatory ability (I discuss this decision further in the 'Limitations' section below). For the purposes of analysis, the three group types (two homogenous, one heterogeneous) were actually made into four groups, to reflect the students' regulatory ability within each pair (Low/Low, Low/High, High/Low, and High/High). Despite the fact that the Chi-square goodness-of-fit test showed that groups were not evenly distributed with regard to pair type, I moved ahead with analyses. One of the major challenges within this study was, within the sample I had, finding enough students who had "low" levels of regulation to fill out the cells for the design (also discussed in 'Limitations').

Using the previously mentioned categorical HTKS change variable, the vast majority of low-regulated students, whether paired with another low-regulated student or a high-regulated student, increased their score from the individual to paired assessment. A slight majority of high-regulated students paired with another high-regulated student also increased in score; however, a small proportion of high-regulated students who were paired with low-regulated students showed

a decrease in HTKS score. One explanation for this result may be that having a partner with low regulatory ability distracts high-regulated children. Conversely, however, low-regulated children seem to show an increase in score regardless of whether they are paired with another low-regulated child or a high-regulated child. This may be due, in part, to practice effects, but also that students were paired with another student who had already completed the task once before as well; thus, the fact that both a low-regulated student and their partner (regardless of that partner's ability) were fairly knowledgeable about the task may have proved beneficial for that child. In order to examine this further, the categorical HTKS growth variable represented the degree to which children's score increased or decreased, based on the number of standard deviations above or below the mean. Low-regulated children in both Low/Low and Low/High pairs showed similar levels of HTKS score growth above the mean. While this is unsurprising, given that low-regulated students have more room for improvement on the assessment than high-regulated students, the fact that high-regulated students in a High/Low group decreased slightly, on average, with regard to their paired HTKS score, is a bit unexpected. Though this decrease was not significant, this suggests that, for educators, there may be a cost/benefit consideration when pairing students with varying regulatory abilities. While, on the one hand, low-regulated students seem to benefit immensely by having a more-knowledgeable (highly-regulated) peer, these same high-regulated students might be slightly distracted and experience a dip in performance on certain tasks. One major question for educators to consider is: do the potential benefits of pairing students with heterogeneous levels of self-regulation outweigh the costs? In most cases, teachers would likely favor such a match in order to help a less-skilled student improve both academically and socially, and risk a highly skilled student experiencing a slight decrease in performance. Parents of highly regulated children, however, may feel differently than

educators about such arrangements. Nevertheless, it is important to get teachers' perspectives on whether and how they make decisions based on children's ability levels. Study 3 of this dissertation examines teachers' perspectives in more detail.

When examining total paired HTKS score as the outcome variable, there was a significant interaction effect of gender and pair type, indicating that boys in Low/Low, Low/High, or High/Low groups scored lower on the paired HTKS task than girls, but not significantly lower. A further investigation as to why this might be the case revealed that among students in Low/Low pairs, those who were paired with a friend showed a significant decrease in paired HTKS score, an effect that was driven by the boys in the sample. Not surprisingly, this suggests that particularly for boys with low regulation, being paired with a low-regulated friend may negatively impact performance on a self-regulation assessment. The obvious practical reason for this is that boys already having low regulatory ability may find it difficult to ignore distractions for a partner with similar low levels of ability. The fact that this effect was found for boys and not for girls is also to be expected, as boys are often found to perform significantly lower on measures of self-regulation and executive function than girls. Notably, in this study, there were no significant gender differences with regard to individual HTKS score, but there were significant gender differences with regard to the paired HTKS score. In previous studies (e.g., Matthews, Ponitz, & Morrison, 2009), girls have frequently outperformed boys on the HTKS task in an individual context. Thus, the results of this study showing no significant gender differences in individual HTKS performance but gender differences in paired HTKS performance warrant future investigation.

When looking at the High/Low pairs, one trend that stood out was with regard to the number of cued trials. On average, these pairs showed the lowest mean number of cued trials

during the paired HTKS task. This suggests that high-regulated students paired with a low-regulated student may have been aware that their partner was less skilled in some regard, and subsequently looked to them less for a correct response. By contrast, the highest mean number of cued trials occurred among the Low/High. This suggests that low-regulated students paired with a high-regulated partner were also very aware that their partner was more skilled or knowledgeable, and chose to look to them more often for a response. This may be a result of students' familiarity with their classmates' abilities near the end of the school year. When looking at results for group differences in the number of cued trials, no interaction effect was significant. However, after plotting the group differences, I noticed that among High/Low pairs, there seemed to be a sharp increase in cued trials among pairs that were also friends. A t-test confirmed that there was a significant group difference among High/Low pairs between friends and non-friends. That is, high-regulated students paired with low-regulated students *that were their friends* exhibited significantly more cued trials during the paired HTKS task. Overall, high-regulated students may be aware when they are paired with a less-skilled partner; however, when that less-skilled partner is a friend, they may be more comfortable in looking to their partner for a response, and may in turn be receiving incorrect information. Notably, this effect was only significant for boys, suggesting that in a partnership between a high regulated and low regulated friend, it may be more distracting to the highly-regulated boy than it is helpful for the low regulated boy. However, it is important to understand that children's regulatory performance was contextually tied to the HTKS assessment, and regulatory abilities will be represented in various ways depending on the activity itself.

Paired HTKS as a Predictor of Academic Achievement

The third primary research question from this study was to determine whether performance on the HTKS assessment in the paired context would be a significant predictor of academic achievement, particularly when controlling for individual HTKS achievement. The results showed that, despite the stronger correlations between the paired HTKS scores and academic achievement than between individual HTKS scores and achievement, paired HTKS performance did not predict either reading or math achievement above and beyond individual HTKS performance. Individual HTKS performance positively predicted math achievement, but not reading achievement, supporting previous research but also representing the type of result that has recently come into question (Jacob & Parkinson, 2015). The fact that paired HTKS performance failed to predict performance on the Woodcock-Johnson Letter Word and Applied Problems subtest does not necessarily indicate that it is not a predictor of academic achievement. Rather, it is not a predictor of this particular *assessment* of academic achievement. It is not surprising that an individual assessment of self-regulation predicted performance on an individual assessment of math achievement. This study had no assessment of math achievement that placed children in a realistic group context, such as a math worksheet completed at a table with other students around them. Students having to utilize more of their executive function skills to concentrate on a paired HTKS assessment may be more likely to achieve highly in the face of potential distractions in the classroom. In addition to measures such as the Woodcock-Johnson subtests, future studies that attempt to determine any predictive validity of a paired self-regulation assessment may also try to use classroom-based measures of achievement.

Examining the Ecological Validity of the Paired HTKS Task

As mentioned previously, a less central but practical goal of the study was to determine whether use of the HTKS task in a paired context would be feasible for future studies. One challenge of adapting the measure was determining how it should be scored. In order to be able to draw conclusions between children's performance in the individual setting and the paired setting, I used the standard (0-2) scoring system that had been established for this measure. However, the paired dynamic yielded a new wrinkle – children looking to their partner for correct responses. I chose to keep the instructions for the paired task exactly the same as the individual one for the sake of consistency across each assessment. However, because children's correct responses and self-corrections could occur as a result of looking at one's partner and not because they remembered the correct response on their own, I found it necessary to count each child's number of cued responses as its own variable. I also created a modified scoring system (0-4) in which cued responses were factored into the score each child earned during the paired assessment. Tables 5 and 6 showed the relations between paired HTKS scores using each of the two scoring methods and academic achievement variables. Although several relations between the two types were evident, notably that relations between academic achievement and total (modified) paired HTKS score provided slightly larger correlation coefficients than total (standard) paired HTKS score, we ultimately decided to focus on the standard score in order to be able to compare between children's performance in both individual and paired contexts. Regardless of the scoring method however, the stronger relations between paired HTKS scores and academic achievement variables might signify the usefulness of conducting a self-regulation assessment in a group environment in future studies, as it more closely reflects how children must regulate themselves on a daily basis.

Relating the Paired HTKS Task to Co-Regulation

Although this study focused mainly on the change in individual children's performance on a self-regulation assessment from an individual setting to a group setting, this dissertation, as a whole, explores the concept of *co-regulation* and what it means for children's development in the classroom. Co-regulation is defined broadly here as children having some level of influence on each other's regulation behaviors, but the different ways in which researchers and educators can define co-regulation vary widely. For example, McCaslin (2009) connects co-regulation to the development of an emergent identity, and suggests that in co-regulated learning, each participant is enriched in some way, and that participation is the construct of interest. Among kindergarteners, whether co-regulation includes some effort on the part of a child to exert control over another child's behavior is a topic to be discussed in future research. In the paired HTKS assessment, children rarely attempted to exercise any control over their partner. Occasionally, a child would gently remind their partner of the correct response to an experimenter's command, such as in the following example:

> **Researcher**: "Touch your head."
>
> *(Child 1 correctly touches toes, Child 2 incorrectly touches head.)*
>
> *(Child 1 looks over at Child 2 and notices they have responded incorrectly.)*
>
> **Child 1:** (whisper) "Toes!"

Despite the instinctual response by some children to help (or seek help) from their partner, generally speaking, a child's response was not connected to that of their partner, in that there was no sense that the children's performance was being evaluated collectively. Thus, because the

objective of the task was not explicitly to work together to achieve some outcome, children may have exhibited fewer behaviors that could be categorized as "co-regulating" behaviors. However, it is important for future research to continue to examine this phenomenon as it occurs within the early childhood period using a variety of activities in order to improve our definition of what constitutes co-regulating behavior.

Limitations

Along with the novelty of this study design comes several limitations. One of the main limitations was the fact that individual and paired HTKS assessments were not counterbalanced. A primary feature of this study design was pairing students based on their individual HTKS scores, which necessitated that the individual assessments preceded the paired assessments. Although it would have been useful to conduct a pilot study beforehand in which children were not paired based on any specific factors simply to eliminate practice effects for the paired HTKS task, time limitations prevented such a pilot study from happening. In future studies, I may decide to obtain teacher-rated and/or parent-rated self-regulation scores in order to avoid the need to obtain individual HTKS scores first, and allow for counterbalancing assessments.

Another limitation was the way in which students were paired, both with regard to peer status and self-regulation ability. In deciding on how to measure peer status, one of the major considerations was whether to use teacher nominations or student nominations in order to categorize students as "friends" or "non-friends." I made the decision to group only by teacher nominations, due to the fact that teachers are most often the ones in control of which students are grouped together; thus, their perception of who "friends" were in the class was the factor most likely to impact how students were grouped naturally. Additionally, each teacher's personal definition of a "best friend" may have differed and subsequently impacted her nomination

choices. In the future, I might define more clearly what teachers need to consider when deciding whether two students are "best friends." Additionally, student nominations were collected, and future studies using this design may focus on a combination of teacher and student nominations in order to ensure that more rigorous criteria for friendship status are met (e.g., only children who are nominated by both the teacher *and* the students as best friends are considered "best friends").

With regard to pairing students by individual self-regulation ability, deciding to pair students relative to the median HTKS score for their gender within their classroom was meant to account for between-class and between-school differences in mean HTKS scores. It was also more feasible to categorize a student as "high" or "low" after collecting all data for one classroom, rather than wait to collect data from the entire sample to obtain the mean HTKS score for all children. However, future research designs may use different methods of categorizing students as "high" or "low", such as the aforementioned adult rating scales, or may use a different categorization system altogether. Related to this, because a major challenge in the study was finding students who fit the "low" self-regulation criteria, I did not have enough low-regulated students to fill out the design, particularly with regard to the "Low/Low, Friend" pairs. Thus, the categorization strategy I used may not have been ideal for filling out all cells of the study design.

In addition to the difficulty of finding a representative sample with regard to students' individual HTKS scores comes the limitation of defining "high" and "low" for the larger population of kindergarten children. While feasible for the purposes of the limited sample in this study, it is crucial that researchers using measures such as the HTKS task begin to make such measures more practical for use in classrooms. In the same way that some standardized tests

have provided a grade equivalent for a particular score, so measures of self-regulation can be made to practically predict student performance over time. In order to address this, data on children's HTKS task performance can be pooled and analyzed in order to have a broader representation of children's performances in the early grades. It would be useful for both researchers and educators to have a more explicit and nuanced system for identifying "at risk" children with regard to self-regulation and executive function skills, rather than relying only on anecdotal observations of children's behavior. Future work might look at psychometrically valid and reliable data to permit longitudinal analysis on the relations between self-regulation scores and student academic achievement over time.

Another limitation for this study was coding the paired HTKS assessment, particularly the "cued trial" variable. This is evident from this variable having the lowest inter-rater reliability among the paired HTKS variables. While I chose to code a "cued trial" as an observer witnessing a child actually turn their head to look at their partner, there was no way to tell whether children were able to "see" (or at least get a sense of) their partner's response in their peripheral vision. Ultimately, because I never explicitly stated in the directions that children could not look to their partner, it is more likely that if children wanted to know their partner's response, they would simply turn their head and do so overtly, rather than look covertly out of the corner of their eye. Essentially, there were no "rules" in this task, so children would likely feel freer to "cheat". Another challenge with coding came in factoring in *when* children looked. At times, a child might look to their partner *during* a response, which made it difficult to decide whether the response was cued or not. Part of the challenge facing coders for this study was deciding whether children acted as a result of seeing their partner, or whether they responded first, and simply looked to their partner for confirmation.

Finally, an overarching limitation of the study was that the characteristics of the sample make it difficult to generalize these results to the greater kindergarten population. The sample was overwhelmingly Caucasian, with two-thirds of the mothers in the sample having a bachelor's degree. As a result, further research using this methodology should use a more diverse population, both economically and ethnically. Conducting future studies with a larger sample would also allow for HLM analyses to parse out classroom and child effects.

Implications

This study has implications for researchers as well as practitioners. Adapting the Head-Toes-Knees-Shoulders task and other measures of young children's self-regulation or executive function skills for use with multiple students simultaneously is something that researchers can continue to work towards. Assessing students' individual abilities using a battery of measures is the standard method, but does not necessarily reflect the true nature of the classroom environment. Children simply do not always act the same way in a one-on-one situation with an adult as they do with their same-age peers in a classroom. The latter represents the environment children are in for the majority of the school day and as a result, research tools should be adapted to reflect this reality. While assessing a pair of children in an isolated setting is only an incremental step toward this end, the need for researchers to improve methodologies that consider both child skills as well as contextual factors is clear. For those who study young children's learning, beginning to understand the ways in which children help *each other* learn is a difficult, but logical direction for educational psychology.

For practitioners, this study highlights the fact that grouping children in systematic ways may have an impact on children's subsequent performance on a task. Teachers often have clear ideas about why they make certain instructional decisions, particularly with regard to which

children work together. Pairing children in a relatively simple, yet systematic way yielded some insights into how children impact each other's development. Although, on this task, friendship status between partners did not seem to have an overall effect on performance with regard to self-regulation, pairing children with varying levels of regulatory abilities did have a significant effect. Self-regulation is a concept most, if not all teachers, are familiar with. Many simply call it something else, such as "self-control". Having a simple yet effective method of assessing children's regulation, such as the HTKS task, at various points throughout the year may be beneficial for teachers. It is necessary for researchers to collaborate with teachers to better understand how teachers think about concepts such as "self-regulation", as well as "co-regulation" and "peer connections". While Study 2 of this dissertation examines more about co-regulating behaviors children exhibit during a problem-solving task, Study 3 will examine teachers' awareness of these phenomena and how they make instructional decisions based on their own knowledge. It is crucial for theoreticians to bridge the gap between research and practice by collaborating with educators in order to help research reflect the classroom reality. This study represented a first step towards strengthening the connection between research and practice. Although there were several limitations in this study, there were also several important implications that highlight some of the goals researchers and educators must strive for.

Future Directions

One aspect of this design I would alter would be to use gender pairs in subsequent research. In this study, pairs were kept homogenous with regard to gender in order to reduce the number of cells within the design. In future studies, I may choose to pair children based on gender, in order to determine what effect gender has, if any on paired HTKS performance. During data collection, I frequently observed classrooms in which children were seated near or

were working with a child of the opposite gender. It would be useful for researchers and educators to understand the potential regulatory benefits, if any, of having boys work with girls.

As mentioned previously, additional studies might counterbalance paired and individual HTKS without pairing students based on any particular factor. This random assignment would help reduce practice effects. Additionally, it would be worth considering employing a different method of assigning children to "high" or "low" regulatory status within a pair. Future studies may also alter the instructions to the paired HTKS task, such as explicitly telling children not to look at their partner, or to have children stand back-to-back to see whether cued trials still occur. Because this was an initial attempt to understand the benefits of adapting an established individual behavioral self-regulation assessment for use with more than one child, it is crucial that researchers continue to evolve measures to increase their ecological validity and overall generalizability to classroom contexts.

Appendix A
Teacher Peer Nomination Sheet

Teacher Name: _____
Date: _____

Classroom Peer Sheet

Directions: For each student in the study, please list *at least* three students whom you consider the child's closest friends in the class. If you can name more, please do so. (*Note: they can be names of students who are not in the study, as long as they are in your classroom*)

Name of Student	Names of that Student's Friends
	1) 2) 3) Others (optional):
	1) 2) 3) Others (optional):
	1) 2) 3) Others (optional):
	1) 2) 3) Others (optional):
	1) 2) 3) Others (optional):
	1) 2) 3) Others (optional):
	1) 2) 3) Others (optional):

Appendix B

Adapted Academic and Social Competence (ASC) Scale

We are interested in learning how this child is doing, compared to other children his or her age who attend kindergarten in a variety of settings. Please respond to each of the following items using the scale below.

Child's name: _____

1: well below children this age
2: below children this age
3: about average for children this age
4: above children this age
5: well above children this age

____ 1) Please rate this child's reading skills.

____ 2) Please rate this child's math-related skills.

____ 3) Please rate this child's social skills.

____ 4) How well do you expect this child to do next year in reading?

____ 5) How well do you expect this child to do next year in math?

____ 6) How well do you expect this child to do next year socially?

Appendix C:
Head-Toes-Knees-Shoulders (HTKS) Task of Executive Function

Head-Toes-Knees-Shoulders (HTKS)

General Guidelines

- **Administration:**
  - There are specific instructions to the assessor that are in *italics* and should NOT be read to the child.
  - Dialogue to be read to the child is generally located within a Text box and in **bold font,** read the dialogue aloud **verbatim**. Do not make any changes or additions to the dialogue (the only exception to this is during the practice section where assessors are prompted to provide positive feedback for correct responses.)
  - Never give feedback during the testing section (only during introduction and practice).
  - Be careful not to cue the child during the testing section. After reading aloud the instruction, look directly at the child's eyes. Do not look at his/her head, toes, knees, or shoulders.
  - Demonstrate the correct response when you see:  (during the introduction and practice sections.)
  - Do not repeat a test trial, unless the child indicates that they did not hear the instructions.
  - Do not penalize a child for *thinking* about where to place his/her hands. So long as the child does not move towards an incorrect body part before touching the correct part, then the child should receive the full 2 points.
  - Administer the task in an upbeat and positive tone. Children enjoy playing this game!
- **Testing Environment**
  - If possible, find a testing location that is quiet and in an isolated area. Ideally, no other children should be in the same room as the child being tested.
  - If parents request to sit-in during the testing section – ask parents to sit/stand quietly behind the child and out of the child's sight.
  - Have the child stand approximately 3 feet away from you. Administer the task seated or standing, but make sure that you are facing the child.
  - It is not necessary to force the child to remain in the same spot during the test, so long as the child is paying attention to you and to the task.

Scoring Guidelines

SCORE	RULE	EXAMPLE
0	Child touches the wrong body part and does not self-correct	The assessor says, "Touch your knees." The child quickly reaches up to touch her shoulders but then reverses and touches her knees, holding her hands on her knees.
1	Child makes any discernable motion toward an incorrect response but then changes his/her mind and makes the correct response	The assessor says, "Touch your shoulders." The child briefly jerks his hands upwards but then just as quickly puts his hands down and bends to touch his knees.
2	Child produces the correct (opposite) response immediately.	The assessor says, "Touch your toes." The child looks down at her toes but does not bend towards her toes. After a pause, she places both hands on her head.

HTKS Administration FAQ

1. Are you allowed to repeat a trial if you miss a child's response? We do repeat a command if there's too much noise (e.g., we're in a corner of the classroom) and it's obvious the child didn hear us, or they act like they didn't hear what we said. This doesn't happen very often and it h made no difference in the results we have found. On the rare occasions that we have missed a answer we do ask the child to show us again.

2. Are you allowed to repeat a trial if the child misses what you say and asks you to repeat the trial? Yes, we repeat a command if they don't hear it.

3. Do you wait between instructions before moving on to the next prompt (e.g., touch your head Yes, we wait for the response before moving on to the next prompt.

4. What code do you use if the child does not move at all or refuses to participate for the test trials? If after we repeat a command, they still don't do anything, we mark it as wrong and continue through the task.

5. How would you code a child's response if he or she just moves his or her hands back and forth continuously from their head to their toes? We wait until they finish, and keep giving the task (even if they get the items wrong). After all, being able to listen, pay attention and remember the instructions is required for the task.

6. If the child asks if they are doing ok or giving the right responses during the test trials, are you allowed to say something neutral like "You're giving a lot of good answers?" Or should you say nothing at all? If a child asks how they are doing, we say something like "you're really good at these games."

Examples and Scoring Suggestions

*For the following examples, assume that the child has his hands on his head at the start of the trial:

COMMAND	CHILD RESPONSE	SCORE
Touch your Toes	Child keeps hands on head	2
Touch your Toes	Child briefly raises hands upward off of head – and makes no downward motion towards toes – and then replaces hands on head	2
Touch your Toes	Child removes hands from head and briefly moves hands in downward motion before returning hands to head	1
Touch your Head	Child keeps hands on head	0
Touch your Head	Child removes hands from head and touches toes	2
Touch your Head	Child removes hands from head but starts to move hands back towards head, but then touches toes	1

HEAD-TOES-KNEES-SHOULDERS (HTKS)

Parts I, II, and III
FORM A - Extended

Child name	_____
Birthdate	_____
ID #	_____
Gender	_____
Examiner name	_____
Today's date	_____

Directions: After establishing positive rapport with the child, say or read the directions in **bold type** aloud. Words in CAPITAL LETTERS should be emphasized. Administer the task seated or standing; the child should stand, about 3 feet from you, during the task. *Administer Part II* if child responds correctly (include self-corrects) to 5 or more items on Part I of the task, *or* if child is in kindergarten or beyond. *Administer Part III* if child responds correctly (include self-corrects) to 5 or more items on Part II of the task, *or* if child is in first grade or beyond.

The person symbol indicates that you should perform the motion to demonstrate the correct movement to the child. If the child produces the correct (opposite) response immediately, score the item "2". If they self-correct to the correct response, score the item "1". If they do not touch the correct part of their body at all or touch the named part, score the item "0".

A self-correct occurs if the child makes any discernible motion toward an incorrect response, but then changes his/her mind and makes the correct response. Pausing to think, not moving, and then responding correctly does not count as a self-correction – it would be scored as correct.

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PART I: INTRODUCTION

Now we're going to play a game. The game has two parts. First, copy what I do. Touch your head.

Touch your head; wait for the child to touch his/her head.

Good! Now touch your toes.

Touch your toes; wait for the child to touch his/her toes.
Repeat the two commands with motions again, or until the child imitates you correctly.

PART I: PRACTICE

Now we're going to be a little silly and do the OPPOSITE of what I say. When I say touch your HEAD, INSTEAD of touching your head, you touch your TOES. When I say touch your TOES, you touch your HEAD. So you're doing something DIFFERENT from what I say.

If the child responds correctly: Provide positive feedback on each practice item where the child responds correctly.

***If the child responds incorrectly* at any point during the practice portion, provide additional explanations up to 3 times before beginning the test portion:

Remember, when I say to touch your ____, you touch your ____, so you are doing something DIFFERENT from what I say. Let's try another one.

→ Number of additional explanations given: 0 1 2 3

A1. **What do you do if I say "touch your head"?**	0 (other than toes)	1	2 (toes)
A2. **What do you do if I say "touch your toes"?**	0 (other than head)	1	2 (head)

If the child responds verbally: "can you show me? "

Ok, let's practice a few more.

B1. **Touch your head**	0 (other than toes)	1	2 (toes)
B2. **Touch your toes**	0 (other than head)	1	2 (head)
B3. **Touch your head**	0 (other than toes)	1	2 (toes)
B4. **Touch your toes**	0 (other than head)	1	2 (head)

Proceed to Part I test section. Do not explain any parts of the task again. Do not provide feedback during the test portion.

PART I: TESTING

We will keep playing this game, and you keep doing the OPPOSITE of what I say.

	Incorrect	Self-Correct	Correct
1. **Touch your head**	0 (other than toes)	1	2 (toes)
2. **Touch your toes**	0 (other than head)	1	2 (head)
3. **Touch your toes**	0 (other than head)	1	2 (head)
4. **Touch your head**	0 (other than toes)	1	2 (toes)
5. **Touch your toes**	0 (other than head)	1	2 (head)
6. **Touch your head**	0 (other than toes)	1	2 (toes)
7. **Touch your head**	0 (other than toes)	1	2 (toes)
8. **Touch your toes**	0 (other than head)	1	2 (head)
9. **Touch your head**	0 (other than toes)	1	2 (toes)
10. **Touch your toes**	0 (other than head)	1	2 (head)

TOTAL (Self-Correct + Correct) → ☐

***If the child responds correctly (include self-corrects) to 5 or more items on Part I of the task, or if child is in kindergarten or beyond, continue to Part II.*

*If the child should **not** continue to Part II:* **Thank you for playing this game with me today!**

PART II: INTRODUCTION

Ok, now that you've got that part, we're going to add a part. Now, you're going to touch your shoulders and your knees. First, touch your shoulders.

Touch your shoulders; wait for the child to touch his/her shoulders.

Now, touch your knees.

Touch your knees; wait for the child to touch his/her knees.
Repeat the two commands with motions again, or until the child imitates you correctly.

PART II PRACTICE:

Ok, now we're going to be silly again. You keep doing the opposite of what I say like before. But this time, touch your knees and shoulders. When I say to touch your KNEES, you touch your SHOULDERS, and when I say to touch your SHOULDERS, you touch your KNEES.

If the child responds correctly: Provide positive feedback on each practice item where the child responds correctly.

***If the child responds incorrectly* at any point during the practice portion, provide additional explanations up to 2 times before beginning the test portion:

Remember, when I say to touch your ____, instead of touching your knees, you touch your ____. Do the OPPOSITE of what I say.

Number of additional explanations given: 0 1 2

C1. **What do you do if I say "touch your knees"?**	0 (other than shoulders)	1	2 (shoulders)

If the child responds verbally: "can you show me? "

D1. **Touch your knees**	0 (other than shoulders)	1	2 (shoulders)
D2. **Touch your shoulders**	0 (other than knees)	1	2 (knees)
D3. **Touch your knees**	0 (other than shoulders)	1	2 (shoulders)
D4. **Touch your shoulders**	0 (other than knees)	1	2 (knees)

Proceed to Part II test section. Do not explain any parts of the task again. Do not provide feedback during the test portion.

Now that you know all the parts, we're going to put them together. You're going to keep doing the opposite of what I say to do, but you won't know what I'm going to say.

There are four things I could say.
If I say touch your HEAD, you touch your TOES.
If I say touch your TOES, you touch your HEAD.
If I say touch your KNEES, you touch your SHOULDERS.
If I say touch your SHOULDERS, you touch your KNEES.

Are you ready? Let's try it.

	Incorrect	Self-Correct	Correct
11. **Touch your head**	0 (other than toes)	1	2 (toes)
12. **Touch your toes**	0 (other than head)	1	2 (head)
13. **Touch your knees**	0 (other than shoulders)	1	2 (shoulders)
14. **Touch your toes**	0 (other than head)	1	2 (head
15. **Touch your shoulders**	0 (other than knees)	1	2 (knees)
16. **Touch your head**	0 (other than toes)	1	2 (toes)
17. **Touch your knees**	0 (other than shoulders)	1	2 (shoulders)
18. **Touch your knees**	0 (other than shoulders)	1	2 (shoulders)
19. **Touch your shoulders**	0 (other than knees)	1	2 (knees)
20. **Touch your toes**	0 (other than head)	1	2 (head)

PART II TESTING:

TOTAL (Self-Correct + Correct) → ☐

***If the child responds correctly (include self-corrects) to 5 or more items on Part II of the task, or if child is in first grade or beyond, continue to Part III.*

Thank you for playing this game with me today!

PART III INTRODUCTION

You are doing so well we just have one more part! Now we are going to change the rules of the game.

When I say to touch your HEAD, you touch your KNEES.
When I say touch your KNEES, you touch your HEAD.
When I say touch your SHOULDERS, you touch your TOES.
And when I say touch your TOES, you touch your SHOULDERS.

Ok? Let's practice!

If the child responds correctly: Provide positive feedback on each practice item where the child responds correctly.

***If the child responds incorrectly* at any point during the practice portion, provide additional explanations up to 2 times before beginning the test portion:

Remember, we changed the rules. "Touch your head" means touch your KNEES – head goes with knees now. "Touch your shoulders" means touch your TOES – shoulders goes with toes.

→ Number of additional explanations given: 0 1 2

PART III PRACTICE:

E1. **What do you do if I say "touch your head"?**	0 (other than knees)	1	2 knees)
E2. **What do you do if I say "touch your shoulders"?**	0 (other than toes)	1	2 (toes)

If the child responds verbally: "can you show me? "

F1. **Touch your head**	0 (other than knees)	1	2 (knees)
F2. **Touch your shoulders**	0 (other than toes)	1	2 (toes)
F3. **Touch your toes**	0 (other than shoulders)	1	2 (shoulders)
F4. **Touch your knees**	0 (other than head)	1	2 (head)

You're doing great! Let's do a few more.

Proceed to Part III test section. Do not explain any parts of the task again. Do not provide feedback during the test portion.

PART III TESTING:

	Incorrect	Self-Correct	Correct
21. **Touch your shoulders**	0 (other than toes)	1	2 (toes)
22. **Touch your head**	0 (other than knees)	1	2 (knees)
23. **Touch your knees**	0 (other than head)	1	2 (head)
24. **Touch your toes**	0 (other than shoulders)	1	2 (shoulders)
25. **Touch your toes**	0 (other than shoulders)	1	2 (shoulders)
26. **Touch your knees**	0 (other than head)	1	2 (head)
27. **Touch your shoulders**	0 (other than toes)	1	2 (toes)
28. **Touch your head**	0 (other than knees)	1	2 (knees)
29. **Touch your head**	0 (other than knees)	1	2 (knees)
30. **Touch your shoulders**	0 (other than toes)	1	2 (toes)

After the child completes the task, say: **Thank you for playing this game with me today!**

Appendix D

Teacher-Rated Self-Regulation Scale

Please complete all 17 items on this instrument for each child on your list by circling the response number that best indicates the degree to which you agree with the statements.

This child:	Strongly Disagree	Disagree	Somewhat Disagree	I don't know	Somewhat Agree	Agree	Strongly Agree
1. waits patiently for her/his turn	1	2	3	4	5	6	7
2. follows one-step instructions	1	2	3	4	5	6	7
3. is easily distracted	1	2	3	4	5	6	7
4. is prone to disturb other children	1	2	3	4	5	6	7
5. has a short attention span	1	2	3	4	5	6	7
6. follows two-step instructions	1	2	3	4	5	6	7
7. leaves seat in classroom in situations in which remaining seated is expected	1	2	3	4	5	6	7
8. only pays attention to things he/she is really interested in	1	2	3	4	5	6	7
9. follows multiple step instructions (e.g., first, wash your hands; second, get some water; third, eat your snack)	1	2	3	4	5	6	7
10. utilizes multiple rules to complete a task	1	2	3	4	5	6	7
11. fidgets with hands or feet or squirms in seat	1	2	3	4	5	6	7
12. waits to be called on before responding	1	2	3	4	5	6	7
13. has difficulty remaining still	1	2	3	4	5	6	7
14. runs about or is very active in situations where it is inappropriate	1	2	3	4	5	6	7
15. interrupts or intrudes on others (e.g., butts into others' conversations or games)	1	2	3	4	5	6	7
16. has difficulty playing or engaging in leisure activities quietly	1	2	3	4	5	6	7
17. restless, always up and on the go	1	2	3	4	5	6	7

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CHAPTER FOUR

Study 2: Examining Co-Regulating Behaviors During a Paired Problem-Solving Task

Introduction

While the primary goal in Study 1 was to investigate children's change in performance on a self-regulation task from an individual to a group context, the main purpose of the current study was to focus on the types of co-regulating behaviors exhibited by children during a problem-solving activity solely within a group context. In Study 1, observed behaviors during the paired Head-Toes-Knees-Shoulders task showed that children's own performance on the self-regulation assessment could be influenced by their partner, as evidenced by cued trials when children would look to their partner for a correct response. However, these cued trials reflected a more passive form of co-regulation, in which children were much more likely to change their own behavior based on their observation of a peer, as opposed to any direct attempt by a peers to affect each other's actions. As discussed in Chapter 2, this may have due in part to the underlying nature of the activity itself, as children's actions occurred in parallel and were not in any way collaborative. By contrast, the current study hoped to better understand whether more purposeful directing behaviors occurred during a problem-solving task in which children were made aware that they needed to work together to achieve a goal, and if so, how those behaviors affected whether the group was successful in solving the problem. In the same vein as Study 1, the current study examined whether and how the factors of peer status and individual regulatory ability within the pairs impacted what types of co-regulating behaviors occurred, as well as the

overall success of the pair in successfully solving the puzzle. Chapter 2 detailed the various definitions of co-regulation, including the similarly defined concept of *socially shared regulation* (Järvelä et al, 2013). Socially shared regulation involves individuals regulating the collective activity of the group. Because I was more interested in individual children's attempts to regulate their partners, this study instead focuses on the dynamic interactions more encompassed by the definition of co-regulation (Hadwin et al., 2011; McCaslin, 2009). The primary research questions for this study were as follows:

- What types of co-regulatory behaviors occur during a problem-solving task between kindergarten students, and how much do they occur?
- Is children's co-regulatory behavior during a problem-solving task influenced by whether they are friends (peer status)?
    - Also, does peer status influence how successful the pair is in solving the task?
- Is children's co-regulatory behavior during a problem-solving task influenced by each child's level of individual self-regulation (regulatory pair type)?
    - Does pair type influence how successful the pair is in solving the task?

Hypotheses

Although there is limited research that investigates the interactions between young children in a problem-solving context, work on peer relationships and interactions in early childhood suggests that close friendships are facilitative (e.g., work by Ladd and colleagues; Azmitia & Montgomery, 1993), and that small-group work encourages perspective sharing, metacognitive awareness, and talk (Cohen, 1994). Work by Neitzel (2009) has coded children's interactions for instructional support to peers, directive behavior, normative information exchanges, passive behavior, and distraction of peers. However, this coding system was

developed with naturalistic observations of children in classrooms, rather than controlled paired scenarios. Thus, I predicted that 1) there would be some level of verbal co-regulating behavior in that would take the form of support and directions, and that this would occur less in non-friend pairs. I had no specific predictions about physical behavior, although I planned to account for children's physical participation within the task itself. Second, I predicted that 2) friends would exhibit more co-regulating behaviors than non-friend pairs, as a result of friends' familiarity with one another. I also hypothesized that friend pairs would score higher on the puzzle task than non-friend pairs, on average, due to this familiarity between partners acting as a facilitating factor. In other words, friends would be more comfortable in communicating more frequently and subsequently working together toward solving the task, whereas non-friends might show a reticence that would slow progress. Although I considered the potential for friends' familiarity to have the opposite effect and become a distraction during the task, much of the literature on peer relationships in early childhood highlights the facilitative nature of these connections; thus, hypotheses were consistent with this work. Finally, I believed that 3) High/High pairs would exhibit the most co-regulatory behaviors, then High/Low pairs, then Low/Low pairs, due to the hierarchical levels of individual regulatory abilities. Furthermore, I believed that High/High groups would show the highest performance on the puzzle task, followed by High/Low groups, and that Low/Low groups would show the lowest performance. Because self-regulation, particularly executive function skills as measured by the Head-Toes-Knees-Shoulders task, has been often associated with academic performance, I felt this hypothesis was warranted.

Method

Participants

As Study 2 built upon Study 1, the sample size in the current study included the same number of participants. The total sample included 150 children, but as a result of odd numbers of consented students within some of the classrooms, all children could not be assigned to pairs. Thus, the final number of participants in the paired activity was 136 (37 boy pairs, 31 girl pairs). The pairs used for the Head-Toes-Knees-Shoulders task in Study 1 were the same pairs used for the tangram activity in the current study.

Procedure

As described in Chapter Two, researchers visited each classroom twice from March to May of 2014. During the first visit, children were assessed individually on several measures, and teachers completed a peer status nomination sheet and two teacher-rating measures for each student in the study. Between the first and second visits, students were systematically paired based on 1) their *peer status* (friends or non-friends) and 2) *regulatory skill level* (Low/Low, High/Low, or High/High). Following the administration of the paired Head-Toes-Knees-Shoulders task from Study 1, children completed a paired classroom challenge task, described in the next section.

Measures

The individual Head-Toes-Knees-Shoulders, Woodcock-Johnson Letter Word Identification and Applied Problems, and teacher-rating scales have all been described in detail in Chapter 2. One additional measure, described below, was included this study.

Classroom Challenge Task. To assess co-regulation behaviors among kindergarteners, the classroom challenge task involved student pairs completing a challenging tangram puzzle task. Berhenke (2013) used this measure previously to assess motivational components such as pride and persistence among individual preschool students. The instructions for the measure were adapted in this study for use with pairs of kindergarten students (see Appendix E). Each pair was given one tangram puzzle comprised of seven shapes, and after the experimenter modeled solving an example puzzle, partners were given eight minutes to work on the puzzle with each other. The children were told that they were to complete as many puzzles as they could, and that they were to work together on the task (the puzzle was placed between the two partners). Finally, they were given only one hint to help them solve the puzzles: that they were to start by placing the two large triangle pieces. The task was videotaped for later coding of several variables, including co-regulation behaviors and previously established motivation constructs such as pride, persistence, and frustration.

Achievement Goal Orientation. Following the end of the eight minute trials, students were asked "If you have more time to work, would you like to keep working on this puzzle or work on one you already did before?" adapted from questions used in work by Smiley and Dweck (1994). This question was intended to determine whether children were mastery-oriented (e.g., wanted to continue working on the one they had not solved yet) or performance-oriented (e.g., wanted to work on a previously completed puzzle). Children were instructed to put their heads down, cover their eyes, and hold up one or two fingers as their response to ensure they did not say their answer aloud and potentially influence their partner's response.

Coding

During the task, children exhibited a variety of behaviors that were categorized as attempts to influence, or regulate, their partner. These will be referred to as *co-regulation* variables of interest, which are defined as either 'verbal' or 'physical'. See Table 4.1 for inter-rater reliability data on tangram task variables coded from video. For complete coding protocol, see Appendix F. For sample coding sheet, see Appendix G.

Verbal Co-regulating Behaviors

Facilitating Direction: These were children's utterances characterized by an apparent attempt by a child to provide information that (they presumably believed) would help in solving the puzzle (e.g., "We're supposed to start with the two big pieces") or to compel their partner to complete a specific action (e.g., "flip it", "put it there," etc.).

Preventative Direction: These were children's utterances characterized by an apparent attempt to stop one's partner from completing a specific action (e.g., "No, no", "stop", "wait", "don't put it there", etc.). They stood in direct contrast to facilitating direction in that they did not provide specific information toward solving the goal, but merely attempted to curb the other child's actions. This is not to imply that preventative direction behaviors were not goal-oriented; indeed, children may very well have tried to hinder a partner's action *because* they believed it would lead the group further away from solving a specific goal.

Physical Co-regulating Behaviors

Facilitating Direction: This variable was characterized by instances when a child's physical action was an apparent attempt to influence or regulate their partner by

providing some type of assistance or guidance (e.g., handing a piece to a partner, pointing out where to put the piece, etc.).

Preventative Direction: This variable was characterized by instances when a child's physical action was an apparent attempt to influence of regulate their partner by stopping or halting them before they could carry out an action (e.g., grabbing a piece from a partner, pushing their hand or arm away as they try to place a puzzle piece).

In addition to coding for the co-regulating behaviors by each individual child, we also coded children's *immediate responses* to their partner's attempts to influence their behavior. These variables were defined based on whether they were a direct result of either a verbal or physical direction by a partner, and whether the child's action happened within a three-second window following a partner's verbal or physical co-regulating behavior.

Responses to Co-regulating Behavior

Response to Verbal Direction: This variable was characterized by a conscious decision by a child to respond to their partner's spoken direction (e.g., Child 1: "Put that here", Child 2 responds by placing piece in that spot).

Response to Physical Direction: This variable was characterized by a conscious decision by a child to perform a task-related action in response to their partner's physical direction (e.g., Child 1 points to a spot, Child 2 responds by placing piece in that spot).

On-Task Behaviors

In addition to the co-regulation variables of interest, I was also interested in how on or off-task each child was during the tangram activity. Rather than simply code for "Time on Task",

I focused on two variables of interest to signify on-task behaviors. First, research assistants and I coded *Attention to Task* with regard to whether children appeared to be paying attention the puzzle activity. Because children would often watch their partner's actions without being physically involved with the puzzle, we chose to characterize "attention" as children looking at the puzzle. Second, to account for more specific behaviors in which children appeared to have an active role in solving the puzzle, we also coded *Physical Involvement* as the amount of time children had a puzzle piece in their hand. Despite the fact that children in possession of a puzzle piece were not always placing it (e.g., they may have been waiting for a partner to complete an action before doing so), we nevertheless decided that this constituted 'involvement' because their possession of at least one of the pieces ensured that the puzzle would not be completed without some action on their part. However, there were instances when a child could be "physically involved" but not paying attention. For example, a child might hold a puzzle piece in their hand but be looking off to the side for an extended period of time. For both of these variables, we calculated the number of seconds children were both attending to and physically involved in the puzzle.

Motivational Behaviors

In previous work by Berhenke (2013), the tangram task has been used to capture several motivational constructs, namely persistence, pride, and frustration. Although examining the motivational behaviors elicited by the paired tangram task was not a primary objective of the study, it was considered theoretically useful to contribute to research that accounts for these motivational constructs within the early childhood period. Verbal behaviors observed were coded for *Task Difficulty* (e.g., "this puzzle is really hard"), *Ability*: (e.g., "I can't do this"), *Pride/Excitement* (e.g., "we did it!"), *Expectation of Success*: (e.g., this is going to be easy"),

Persistence: (e.g., "let's just keep going"), *Attribution*: (e.g., "we don't have enough pieces", these don't all fit on here", etc.), and *Information Seeking*: (e.g., "is this right?", "are we getting closer?"). Of the physical behaviors we observed, we coded for *Pride/Excitement*: (e.g., child claps excitedly, puts hands up when group finishes, etc.) and *Frustration/Disengagement*: (e.g., child leans back/slumps in chair, folds arms, etc.). We also coded for both verbal and physical behavior that did not seem to have any relation to the task at hand, and termed them *Verbal Other* (e.g., child talks about their weekend, makes noises, etc.) and *Physical Other* (e.g., child briefly glances away from task), respectively.

Task-Related Variables

Finally, as an outcome of interest, research assistants and I coded for the number of puzzles each pair were able to successfully solve within the eight-minute window. To account for instances where partners were nearly finished solving the puzzle, we created a "puzzle score", coded as follows: 0 – *Did not solve (fewer than 4 pieces correctly placed),* 1 – *Majority solved (4 of 7 pieces correctly placed)*, and 2 – *Successfully solved (all pieces correctly placed).* Because this score reflected a more accurate assessment of how pairs performed on the task, we chose to use Puzzle score for the analyses. Additionally, we coded for the number of experimenter comments that were made to 1) provide information, such as a reminder of the initial hint to "start with the two big pieces", and 2) provide encouragement to partners that became less interested in the task as needed, which we used as control variables.

Table 4.2 shows the ranges, means, and standard deviations of tangram task variables. Several of the variables in this study, particularly motivational variables that had been used in previous work by Berhenke (2013) were coded for, but did not occur in a majority of trials.

Table 4.1. Inter-rater reliability for tangram task variable coding.

Variable Name	ICC
Attention (Seconds)	.88
Physical Involvement (Seconds)	.97
Verbal Facilitating Direction	.99
Verbal Preventative Direction	.85
Verbal Task Difficulty	.99
Verbal Ability	.96
Verbal Pride	.93
Verbal Expectation of Success	.87
Verbal Persistence	.80
Verbal Attribution	.89
Verbal Information Seeking	.87
Verbal Other	.92
Physical Facilitating Direction	.95
Physical Preventative Direction	.89
Physical Frustration	.89
Physical Pride	.93
Physical Other	.87
Response to Verbal Direction	.79
Response to Physical Direction	.82
Puzzles Finished	.99
Puzzle Score	.99
Experimenter Information	.90
Experimenter Encouragement	.81

Table 4.2. Descriptive statistics for co-regulation, motivation, and task-related tangram variables.

Variable	Range	Mean (SD)
Attention to Task (sec)	228-480	465.41 (33.40)
Physical Involvement (sec)	147-480	381.19 (83.62)
% Attention to Task	.48-1.00	.97 (.07)
% Physical Involvement	.31-1.00	.79 (.17)
Facilitating (Verbal)	0-36	8.95 (7.64)
Preventative (Verbal)	0-13	2.99 (3.29)
Facilitating (Physical)	0-10	2.29 (2.19)
Preventative (Physical)	0-23	3.13 (3.07)
Task Difficulty (Verbal)	0-19	1.42 (2.39)
Ability (Verbal)	0-12	1.71 (2.48)
Pride/Excitement (Verbal)	0-8	1.14 (.69)
Expectation of Success (Verbal)	0-4	.61 (.85)
Persistence (Verbal)	0-5	.12 (.54)
Attribution (Verbal)	0-5	.61 (1.00)
Information Seeking (Verbal)	0-12	2.36 (2.80)
Other (Verbal)	0-29	5.03 (4.73)
Frustration (Physical)	0-10	.48 (1.25)
Pride (Physical)	0-6	.37 (1.00)
Other (Physical)	0-16	3.94 (3.22)
Response to Verbal Direction	0-4	.94 (1.21)
Response to Physical Direction	0-8	1.33 (1.88)
Puzzles Finished	0-6	1.03 (.67)
Puzzle Score	1-13	3.14 (2.01)
Experimenter Information	1-10	4.65 (1.84)
Experimenter Encouragement	1-7	2.94 (1.35)

Note. N=145 for all variables.

Correlations Across all Conditions

Table 4.3 shows relations between tangram behavior variables, including co-regulation variables, motivation variables, and task-related variables, such as Attention to task, Physical involvement, and Puzzle score. The two response variables (Response to verbal direction and Response to physical direction) were not related to any other variables, and were excluded from the table. The results revealed several significant relations. Among the co-regulation variables, Verbal facilitating direction was significantly positively correlated with Verbal preventative direction ($r = .56$, $p < .001$) and Physical facilitating direction ($r = .38$, $p < .001$). Verbal preventative direction was moderately correlated with Physical facilitating direction ($r = .23$, $p < .01$) and Physical preventative direction ($r = .35$, $p < .001$). Physical facilitating direction was not correlated with Physical preventative direction. Collectively, these relations suggest that, for the most part, the more children used one type of co-regulating behavior (either verbal or physical), the more likely they were to use other types, regardless of whether they were facilitating or preventative. Finally, each of the four co-regulating variables was negatively correlated with Puzzle score, with varying degrees of significance, indicating that the more that co-regulating behaviors emerged, the worse children performed on the puzzle task.

With regard to the task-related variables (Attention to task and Physical involvement), there were some notable trends. Attention to task was associated with Verbal preventative direction ($r = .19$, $p < .05$). By contrast, physical involvement showed a negative correlation with Physical facilitating direction, suggesting that the more physically involved children were, the less they were likely to show facilitating physical behaviors, such as pointing out to a partner where a piece should go or handing their partner a piece. Additionally, physical involvement showed a positive relation with Physical preventative direction ($r = .22$, $p < .01$), indicating that

the more physically involved a child was, the more they were likely to physically prevent their partner from performing a specific action. Both Attention to task and Physical involvement were significantly negatively correlated with non task-related verbal and physical behaviors (Verbal other and Physical other). This suggests that the more attentive and involved a child was during the task, the less likely they were to say or do things unrelated to the task. Finally, Physical involvement showed a weak but significant correlation with Puzzle score ($r = .18$, $p < .05$). This is notable, because it is the only tangram variable to show a significant *positive* correlation with Puzzle score.

Both Verbal facilitating direction and Verbal preventative direction were related to several motivation variables. In particular, Verbal facilitating language showed moderate to strong correlations with Verbal ability ($r = .49$, $p < .001$), Verbal pride ($r = .40$, $p < .001$), Verbal attribution ($r = .41$, $p < .001$), and Verbal information seeking ($r = .38$, $p < .001$). Verbal preventative language also showed positive, albeit slightly weaker relations with these motivation variables. Finally, many of the motivational variables were correlated with each other. Particularly, Task difficulty, Ability, and Verbal pride were significantly related to other motivation variables, such as Attribution, Information seeking, and Verbal other. This suggested that much of the motivational dialogue during the task was related. For example, the more children commented on the difficulty of the task, the more likely they were to attribute lack of success to external factors (e.g., not having enough pieces). Of note is that Task difficulty was correlated with Puzzle score, indicating less success for those children who spent more time verbalizing how hard they felt the task was.

Table 4.3. Correlations among tangram co-regulation and motivation variables.

	Att. to Task	Phys. Inv.	Fac. Dir (V)	Prev. Dir. (V)	Fac. Dir (P)	Prev Dir (P)	Task Dif (V)	(Abil) (V)	Exp. Suc. (V)	Attr. (V)	Info Seek (V)	Other (V)	Other (P)	Puz Score
Att. to Task	--													
Phys. Inv.	.54***	--												
Fac. Dir. (V)	.10	.05	--											
Prev. Dir. (V)	.19*	.07	.56***	--										
Fac. Dir (P)	-.09	-.34***	.38***	.23**	--									
Prev. Dir. (P)	.15^{t}	.22**	.16^{t}	.35***	.05	--								
Task Dif. (V)	-.05	-.14	.25**	.10	.13	-.02	--							
Abil. (V)	-.01	-.01	.49***	.32***	.17*	.01	.19*	--						
Expect. Success (V)	.06	-.05	.17*	.18*	.08	.09	.05	.04	--					
Attrib. (V)	-.07	-.02	.41***	.18*	.11	.02	.43***	.42***	.04	--				
Info Seek	.06	.01	.38***	.27**	.12	-.02	.30***	.37***	.10	.23**	--			
Other (V)	-.25**	-.22**	.20*	.11	.14^{t}	.04	.23**	.23**	.19*	.27***	.36***	--		
Other (P)	-.17*	-.38*	-.22**	-.16^{t}	-.00	-.08	-.09	-.01	-.03	-.14	-.06	.02	--	
Puzzle Score	-.03	.18*	-.20*	-.17*	-.22**	-.14^{t}	-.18*	-.11	-.16^{t}	-.08	-.07	-.18*	-.12	--

Note. N=145. ^{t} $p < .10$., * $p < .05$, ** $p < .01$, *** $p < .001$.
Co-regulating behaviors shaded in gray.

Relations Across Tasks and Individual Measures

Table 4.4 shows correlations between co-regulation variables, self-regulation variables (both individual and paired HTKS scores obtained for Study 1), achievement variables, and teacher-rated variables. Between co-regulation and self-regulation variables, the only significant relation is between Physical facilitating direction and Paired HTKS score (r = -.19, p < .05), indicating that higher scores on the paired HTKS task were associated with fewer instances of attempting to provide physical guidance to a partner on the tangram task (e.g., pointing).

There were several relations between the physical (but not verbal) co-regulating variables and academic achievement and teacher-rated variables. Specifically, Physical facilitating direction was negatively correlated with Woodcock-Johnson Letter Word Identification and Applied Problems subtests, as well as with teacher-rated reading, math, and social skills competency. These correlations were all moderate, but suggest an association between children's tendency to try and provide physical information or guidance to their partner and their academic achievement, as well as teachers' perceptions of their academic and social competencies.

As established in Study 1, children's individual and paired HTKS scores showed significant positive relations with nearly all the achievement and teacher-rating variables, to varying degrees of strength and significance. Notably, teacher-rated math competence showed a much stronger relation with W-J Letter Word Identification scores (r = .60, p < .001) than with Applied Problems scores (r = .44, p < .001).

Table 4.4. Correlations between self-regulation variables, co-regulation variables, academic achievement, and teacher-rating variables.

	Fac. Dir. (V)	Prev. Dir. (V)	Fac. Dir. (Phys.)	Pre. Dir. (Phys.)	HTKS (Ind.)	HTKS (Pair)	WJ-LW	WJ-AP	T-R Read.	T-R Math	T-R Soc.	T-R Inhib.	T-R Att.	T-R WM
Fac. Direction (Verbal)	--													
Prev. Direction (Verbal)	.54***	--												
Fac. Direction (Physical)	.32***	.17*	--											
Prev. Direction (Physical)	.08	.30**	-.07	--										
HTKS (Ind.)	.04	-.05	-.15	.11	--									
HTKS (Paired)	.05	-.09	-.19*	.05	.58***	--								
WJ-Letter Word ID	.11	-.01	-.27**	.08	.23*	.33***	--							
WJ-Applied Problems	.05	-.04	-.29**	.15^{t}	.42*	.40***	.60***	--						
T-R Reading Competency	.02	-.01	-.20*	.09	.29**	.34***	.57***	.40***	--					
T-R Math Competency	.06	-.04	-.24**	.15^{t}	.23*	.31***	.60***	.44***	.82***	--				
T-R Social Skills	-.13	-.09	-.17*	.05	.28**	.23**	.18*	.27**	.43***	.39***	--			
T-R Inhibition	-.09	.02	-.05	.03	.19*	.12	.01	.22*	-.01	-.01	.31***	--		
T-R Attention	-.06	-.10	-.10	.04	.17^{t}	.19*	.01	.23**	.14	.20*	.34***	.71***	--	
T-R Working Memory	-.15^{t}	-.17^{t}	-.13	.07	.18*	.14*	.19*	.30**	.18*	.24**	.27**	.38***	.57***	--

Note. N = 124. ^{t} $p < .10$., * $p < .05$, ** $p < .01$, *** $p < .001$.
Co-regulating behaviors shaded in gray.

Main Effect of Peer Status on Co-Regulatory Variables and Tangram Performance

After establishing the relations between co-regulation, motivation, academic achievement, and teacher-rated variables of interest, I now turn toward addressing the primary research questions of the study. To focus on the first question of whether peer status within a pair impacted children's verbal and physical co-regulating behaviors, I conducted a 2 by 2 by 4 (gender by peer status by regulatory pair type) MANOVA analysis. Table 4.5 shows the significant multivariate effects at the $p < .05$ level. Overall, there were no main effects of peer status on any of the co-regulating behaviors. However, there was a main effect of peer status within the pair on tangram performance, $F(1, 135) = 11.33$, $p < .001$; Wilk's $\lambda = .89$, partial $\eta^2 = .11$. Across all students in the sample, non-friends ($M = 3.57$, $SD = 2.35$) significantly outperformed friends ($M = 2.53$, $SD = 1.16$) on the puzzle task. This group difference was confirmed by an independent samples t-test, $t(134) = 3.12$, $p = .002$. Figure 4.1 depicts puzzle score between friend and non-friend groups across all pair types. Despite the fact that the interaction effect was not significant, the graph represents a visual representation of how the non-friend advantage remained stable despite the individual regulatory differences within each pair. Overall, this main effect of peer status on puzzle score suggests that the friendship dynamic within each pair had some influence on the group's success on the task itself.

Table 4.5. MANOVA results for tangram task variables.

Effect	Wilk's λ	partial η^2	*F*	*df*	Error *df*
Puzzle Score					
Peer Status	.89	11%	11.33**	6	115
Verbal Preventative Language					
Gender	.92	8%	3.66*	6	115
Peer Status*Pair Type	.82	6%	4.42**	18	326
Physical Involvement (seconds)					
Peer Status*Pair Type	.82	6%	2.68*	18	326

Note. N = 136. ^{t} $p < .10$., * $p < .05$, ** $p < .01$, *** $p < .001$.

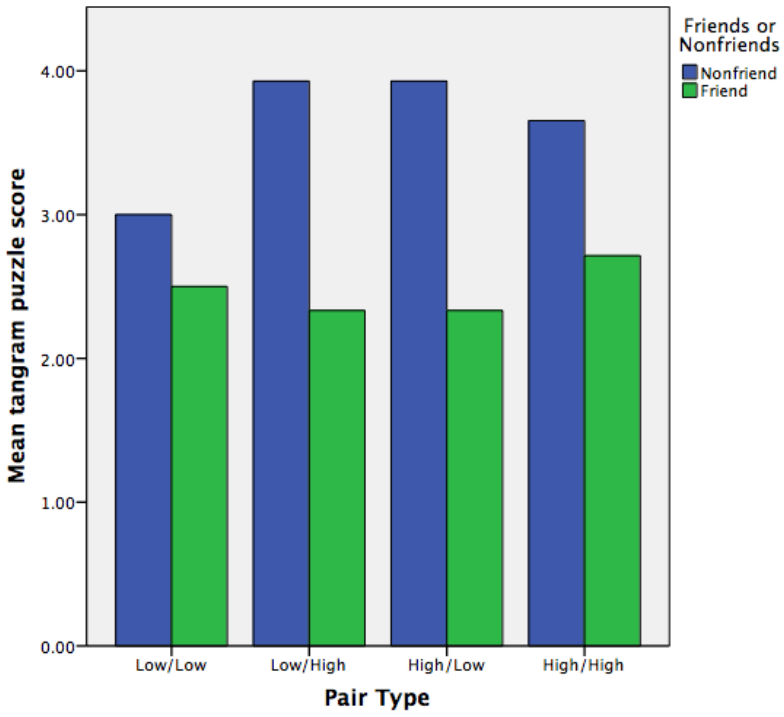

Figure 4.1. Puzzle scores across pair types and peer status (all students).

Main Effect of Regulatory Pair Type on Co-Regulatory Variables and Tangram Performance

MANOVA analysis results showed that for all students, there were no main effects of regulatory pair type on each of the four co-regulation behavior variables, indicating that co-regulatory behaviors did not significantly differ due to the dynamic between individual regulatory abilities within each pair. Additionally, the results did not show a main effect of regulatory pair type on puzzle score, indicating that students' did not differ as a function of the type of pair they were in. This result was contrary to the hypothesis that there would be a hierarchical pattern with regard to performance on the tangram task, with High/High pairs showing the highest performance on the puzzle task, followed by High/Low pairs, and then Low/Low pairs.

Main Effect of Gender on Co-Regulatory Variables and Tangram Performance

Results of the MANOVA analysis indicated that among the co-regulatory behaviors, there was a significant gender difference for verbal preventative directing language, $F(1, 135) = 3.66$, $p < .05$; Wilk's $\lambda = .93$, partial $\eta^2 = .08$. On average, girls tended to show significantly more instances of preventative language ($M = 3.90$, $SD = 1.84$) than boys ($M = 2.54$, $SD = 1.68$), $t(143) = -2.15$, $p = .03$. There were no gender differences with regard to success on the puzzle task.

Interaction Effect on Co-regulating Behaviors

The results of the MANOVA analysis indicated that there was a significant peer status by pair type interaction effect for one of the co-regulating behaviors—verbal preventative directing language, $F(3, 135) = 4.42$, $p < .01$; Wilk's $\lambda = .82$, partial $\eta^2 = .06$. Figure 4.2 illustrates this interaction. Children that were low-regulated and paired with a low-regulated friend tended to

use less preventative directing language, $t(28) = 1.94$, $p = .06$ (although this was not quite statistically significant), whereas high-regulated children paired with a high-regulated partner that was a friend tended to use significantly more preventative directing language, $t(52) = -2.86$, $p = .01$.

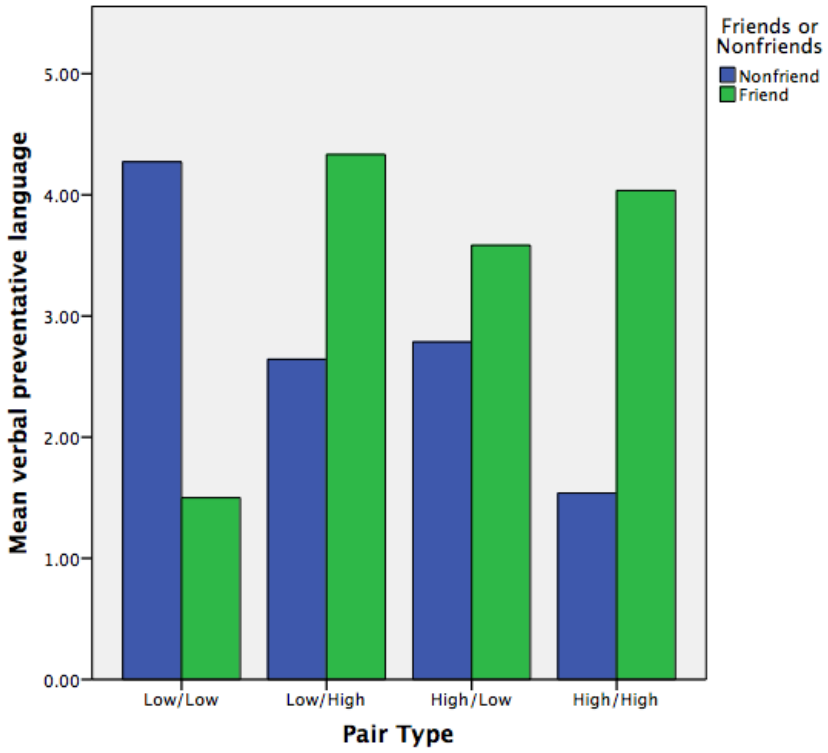

Figure 4.2. Pair type by peer status interaction effect on preventative directing language (all students).

Interaction Effect on Physical Involvement

After examining the effects of peer status and regulation pair type on the co-regulation variables and Puzzle score as outcomes, I also wanted to determine whether there were group differences on the number of seconds children spent physically involved in the puzzle task. Although this was not a primary research question, physical involvement in the task was shown to be positively correlated with tangram puzzle score, and thus, became a variable of interest and

a measure of "on-task" behavior. MANOVA analysis showed that there was no main effect of peer status, $F(1, 135) = .22$, $p = .63$, or pair type, $F(3, 135) = 1.86$, $p = .14$. The interaction effect, however, was significant, $F(3, 135) = 2.68$, $p < .05$. Adjusted R-squared was .04. Figure 4.3 depicts this interaction effect. High-regulated students paired with a low-regulated friend were significantly less physically involved in the task, on average, $t(24) = 2.60$, $p < .05$. Additionally, low-regulated students paired with a high-regulated friend were significantly more physically involved in the task, on average, $t(24) = -2.08$, $p < .05$. This result suggests that low-regulated children paired with a high-regulated partner were more likely to be physically involved in the task if that partner was a friend. Conversely, high-regulated children paired with a low-regulated partner were less likely to be physically involved in the task if that partner was a friend.

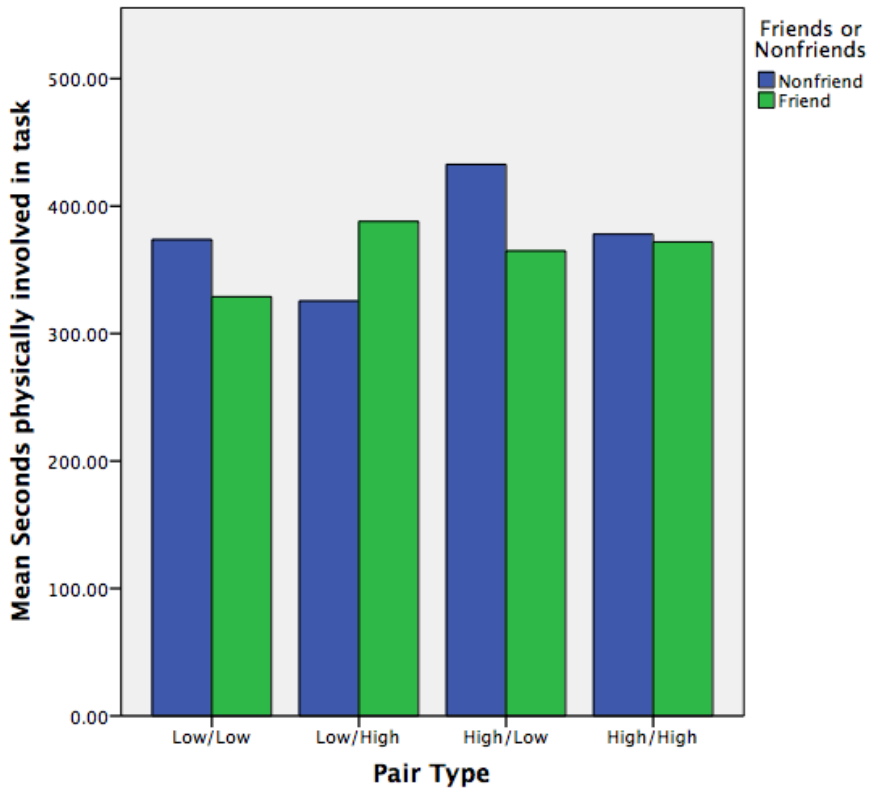

Figure 4.3. Pair type by peer status interaction effect on physical involvement (all students).

Predictors of puzzle score

Having previously established the main effect of peer status on Puzzle score (with non-friends scoring higher than friends, on average) with MANOVA analyses, I wanted to determine what other factors may have led pairs to have success, or lack thereof, on the tangram task aside from peer status. An OLS linear regression model was used to determine which factors significantly predicted Puzzle score. Table 4.6 presents the final model for puzzle score.

Table 4.6. Predictors of puzzle score.

Variable	Final Model (*df*)	*β*	
Puzzle Score	$F(12, 124) = 3.16$***		Model $R^2 = .18$
Gender		-.11	
Age		.01	
Mother education level		-.10	
Peer status (friend = 1)		-.23**	
HTKS score (paired)		.19*	
Physical involvement (seconds)		.19*	
Verbal facilitating language		-.19*	
Verbal preventative language		.05	
Physical facilitating behavior		-.05	
Physical preventative behavior		-.17^{t}	
Off-task behavior (verbal)		-.13	
Off-task behavior (physical)		-.17^{t}	
Experimenter information		-.15	
Experimenter encouragement		.21*	

Note. N = 136. ^{t} $p < .10$., * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4.6 shows that among the most significant predictors of performance on the tangram task, being paired with a friend (regardless of that friend's regulatory ability) was a negative predictor of puzzle score (standardized $\beta = -.23$, $p < .01$). This was unsurprising, as the

MANOVA analyses found that non-friend pairs significantly outperformed friend pairs on the tangram task. However, the regression model confirms peer status as a significant predictor, controlling for other variables. The number of seconds children spent physically involved in the task was a positive predictor of puzzle score (standardized $\beta = .19$, $p < .05$). Additionally, children's performance on the paired HTKS assessment positively predicted success on the tangram task (standardized $\beta = .19$, $p < .05$). Experimenter encouragement was also found to be a significant positive predictor of puzzle score (standardized $\beta = .21$, $p < .05$). Finally, among co-regulating behaviors, verbal facilitative direction was a negative predictor of puzzle performance (standardized $\beta = -.19$, $p < .05$). This result suggests that, of the co-regulating behaviors examined in this study, the amount of verbal facilitating language may have actually led to decreased performance on the tangram task.

Predictors of Physical Involvement

Because children's physical involvement was a positive predictor of group success on the tangram task, I wanted to determine what variables significantly predicted how physically involved children were during the task. Table 4.7 shows the results of the regression analysis. In addition to the number of seconds children attended to the task (used as a control variable) being the strongest predictor of physical involvement (standardized $\beta = .45$, $p < .001$), three of the co-regulating behaviors were significant predictors of physical involvement. Verbal facilitative direction was a positive predictor (standardized $\beta = .21$, $p < .05$), as was physical preventative direction (standardized $\beta = .23$, $p < .01$). By contrast, physical facilitative direction was a strong negative predictor of physical involvement on the task (standardized $\beta = -.30$, $p < .001$). Additionally, physical off-task behavior (e.g., getting out of seat, glancing around room, etc.) was a strong negative predictor of physical involvement (standardized $\beta = -.29$, $p < .001$).

Overall, the results show that verbal facilitative language positively predicted children's physical involvement on the task, and physical involvement positively predicted success on the tangram task. Paradoxically, verbal facilitative language was a significant negative predictor of success on the tangram task.

Table 4.7. Predictors of physical involvement on tangram task.

Variable	Final Model (*df*)	*β*	
Physical Involvement (sec)	$F(14, 122) = 10.04$***		Model $R^2 = .49$
Gender		.00	
Age		-.01	
Mother education level		-.17	
Peer status (friend = 1)		-.12^{t}	
HTKS score (individual)		.11	
Attention to task (seconds)		.45***	
Verbal facilitating language		.21*	
Verbal preventative language		-.09	
Physical facilitating behavior		-.30***	
Physical preventative behavior		.23**	
Off-task behavior (verbal)		-.07	
Off-task behavior (physical)		-.29***	
Experimenter information		-.03	
Experimenter encouragement		-.06	

Note. N = 136. ^{t} $p < .10$., * $p < .05$, ** $p < .01$, *** $p < .001$.

Predictors of co-regulating behaviors

As mentioned previously, one of the co-regulating behaviors of interest was a significant negative predictor of puzzle performance. The correlations shown in Table 4.3 had already illustrated the significant negative relations between the co-regulating variables and puzzle score. Due to mounting evidence that co-regulating behaviors may have, in fact, hindered pairs' progress on the tangram task, I wanted to determine the predictors of the four co-regulating

behaviors. Table 4.8 and Table 4.9 show final regression models for the verbal and physical co-regulation variables, respectively. All models included variables that were believed to impact these co-regulation behaviors. Woodcock-Johnson Letter Word Identification scores were included because they were believed to relate to language and vocabulary development, which may impact children's use of verbal communication when working with other children. Paired HTKS score was also used. This was because the paired HTKS assessment (discussed in Chapter 3) used the same pairs as the tangram task from the current study. Thus, I felt it important to determine whether performance on a paired self-regulation task would impact co-regulatory behaviors during a paired puzzle task. Peer status and physical involvement were included because they were previously found to relate to group success on the task itself; thus, I felt it important to include them as potential predictors of co-regulatory behaviors. The verbal and physical off-task behaviors were included in the analyses, as was experimenter information. I believed the level of information, (e.g., "remember to start with the two big pieces", "I said you have to cover *all* the yellow", etc.) may have influenced children's use of co-regulatory behaviors, as I witnessed several instances similar to the following example:

> *(Children believe they are finished and present puzzle to researcher)*
> **Researcher**: "Hmm, not quite. Remember I said you can't let any of the pieces overlap."
> **Child 1** ***(to partner)***: "Oh yeah, he said you can't let the pieces overlap. Move this one over here" (*points)*.

Experimenter encouragement was not included, as it was not believed to predict any of the co-regulating behaviors. Encouraging children to "keep trying" may have led children to continue their involvement, but it did not provide any specific information that children could repeat, as in the above example, thereby increasing co-regulatory behaviors.

Table 4.8. Predictors of verbal co-regulating behaviors.

Variable	Final Model (*df*)	*β*	
Verbal Facilitative Language	$F(13, 123) = 9.73$***		Model $R^2 = .46$
Gender (girl = 1)		-.11	
Age		.08	
Mother education level		.05	
W-J Letter Word Identification		.16*	
Paired HTKS Score		.17*	
Peer status (friend = 1)		-.10	
Physical involvement (seconds)		.20*	
Verbal preventative language		.49***	
Physical facilitative behavior		.33***	
Physical preventative behavior		-.13^{t}	
Off-task behavior (verbal)		.15*	
Off-task behavior (physical)		-.11	
Experimenter information		.23**	
Verbal Preventative Language	$F(13, 123) = 8.03$***		Model $R^2 = .41$
Gender (girl = 1)		.25***	
Age		-.08	
Mother education level		-.19*	
W-J Letter Word Identification		.01	
Paired HTKS score		-.12	
Peer status (friend = 1)		.16*	
Physical involvement (seconds)		-.04	
Verbal facilitative language		.54***	
Physical facilitative behavior		-.05	
Physical preventative behavior		.27***	
Off-task behavior (verbal)		-.03	
Off-task behavior (physical)		.01	
Experimenter information		-.07	

Note. N = 136. ^{t} $p < .10$., * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4.9. Predictors of physical co-regulating behaviors.

Physical Facilitative Behavior	$F(13, 123) = 4.84$***	β	Model $R^2 = .27$
Gender (girl = 1)		-.18*	
Age		.03	
Mother education level		-.05	
W-J Letter Word Identification		-.30***	
Paired HTKS score		-.08	
Peer status (friend = 1)		.01	
Physical involvement (seconds)		-.41***	
Verbal facilitative language		.45***	
Verbal preventative language		-.06	
Physical preventative behavior		.10	
Off-task behavior (verbal)		-.08	
Off-task behavior (physical)		-.05	
Experimenter Information		-.04	
Physical Preventative Behavior	$F(13, 123) = 2.65$**		Model $R^2 = .14$
Gender (girl = 1)		-.11	
Age		-.01	
Mother education level		.12	
W-J Letter Word Identification		.07	
Paired HTKS score		.05	
Peer status (friend =1)		-.02	
Physical involvement (seconds)		.39***	
Verbal facilitative language		-.21*	
Verbal preventative language		.39***	
Physical facilitative behavior		.12	
Off-task behavior (verbal)		.08	
Off-task behavior (physical)		.06	
Experimenter Information		.06	

Note. N = 136. ^{t} $p < .10$., * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4.8 shows that several predictor variables account for 46% of the variance in Verbal facilitative directing language, $F(13, 123) = 9.73$, $p < .001$. The strongest predictors of Verbal facilitative directing language were two of the other co-regulating behaviors: Verbal preventative language, (standardized $\beta = .49$, $p < .001$), and Physical facilitative behavior (standardized $\beta = .33$, $p < .001$). Additionally, children's physical involvement in the task positively predicted instances of Verbal facilitative language (standardized $\beta = .20$, $p < .05$). Reading score was another positive predictor (standardized $\beta = .16$, $p < .05$), indicating that children's reading ability had some relation to their use of facilitating directing language during the tangram task. Children's paired Head-Toes-Knees-Shoulders score was also a positive predictor (standardized $\beta = .17$, $p < .05$, indicating a connection between children's performance on a paired self-regulation task and their use of facilitative directing language on this particular paired problem-solving task. Finally, verbal off-task behavior positively predicted verbal facilitative language (standardized $\beta = .15$, $p < .05$), indicating that the more likely children were to engage in verbal utterances unrelated to the task, the more they were likely to use verbal facilitative language as well. Finally, experimenter information was a positive predictor of verbal facilitative language (standardized $\beta = .23$, $p < .01$), indicating that the more I provided children with information during the task, the more verbal facilitative language they would use.

The regression model for Verbal preventative language in Table 4.8 shows that several predictor variables account for 41% of the variance in Verbal preventative language, $F(13, 123) = 8.03$, $p < .001$. There were several differences in predictors when comparing this model with the model for Verbal facilitative language. For one, gender was a positive predictor of Verbal preventative directing language (standardized $\beta = .25$, $p < .001$), with girls being more likely to express language that prevented a partner from completing an action. Additionally, being paired

with a friend positively predicted verbal preventative language (standardized $\beta = .16$, $p < .05$), suggesting that being paired with a friend predicted more use of preventative language during the task. The MANOVA analysis had previously shown a main effect of gender on this particular co-regulating behavior, as well as a peer status by pair type interaction. Of the other co-regulating behaviors, Verbal facilitative language (standardized $\beta = .54$, $p < .001$) and Physical preventative direction (standardized $\beta = .27$, $p < .001$) were positive predictors of preventative language. Mother's education level was a negative predictor (standardized $\beta = -.19$ $p < .05$). That is, higher levels of education for a child's mother predicted fewer utterances of preventative language during the tangram task for that child.

Table 4.9 shows the final regression models for Physical facilitative and preventative co-regulating behaviors. Overall, these models accounted for less variance than the models for the verbal co-regulating behaviors, likely due to the fact there were fewer instances of physical co-regulating behavior, overall. The first model accounts for 27% of the variance in Physical facilitative directing behaviors, $F(13, 123) = 4.84$, $p < .001$. Of the co-regulating behaviors, only Verbal facilitative language was a significant predictor of Physical facilitative behavior (standardized $\beta = .45$, $p < .001$). Children's physical involvement in the task negatively predicted their Physical facilitative behaviors (standardized $\beta = -.41$, $p < .001$). This is likely due to the frequent occurrence of children giving a puzzle piece to another child. This was considered a physical act of co-regulating behavior that facilitated the involvement of a partner. However, by giving a piece to their partner, a child typically was left without a piece in their hand, which would lower their physical involvement in the task. Additionally, gender was a negative predictor of Physical facilitative behavior (standardized $\beta = -.18$, $p < .05$), indicating that girls

were less likely to exhibit this co-regulating behavior. Finally, reading score was a negative predictor of Physical facilitative behavior (standardized β = -.30, $p < .001$).

The regression model for Physical preventative behavior in Table 4.9 shows that the predictor variables account for 14% of the variance in Physical preventative co-regulating behaviors, $F(13, 123) = 2.65$, $p < .01$. Two of the significant predictors were other co-regulatory variables. Verbal facilitative language negatively predicted Physical preventative behaviors (standardized β = -.21, $p < .05$) and Verbal preventative language was a strong positive predictor Physical preventative behaviors (standardized β = .39, $p < .001$). Finally, physical involvement in the task positively predicted Physical preventative behaviors (standardized β = .39, $p < .001$). This stands in contrast to the result in the preceding model, where physical involvement negatively predicted Physical facilitative behavior. In this case, children who engaged in Physical preventative co-regulating behaviors were more likely to *take* a piece from their partner, or push their partner's hand or arm away, often to be able to follow through with their own task-related actions.

In sum, verbal facilitating directing language appeared to play the largest role in both children's success on the tangram task and in how much children expressed the other co-regulating behaviors. It negatively predicted overall performance for the pairs on the tangram task, but paradoxically also positively predicted physical involvement in the task. Verbal facilitating language also positively predicted verbal preventative language. That is, children who were likely to verbally attempt to provide information to their partner were also likely to try and verbally curb their partner's actions. Overall, these results suggest children using more verbal language to express themselves will manifest itself in various ways during a problem-solving task, whether communicating on-task directions to a partner, or off-task "idle chatter."

Discussion

An over-arching goal of this study was to build upon Study 1 by determining what types of co-regulating behaviors occurred between two kindergarten students during a developmentally appropriate, collaborative problem-solving task. Study 1 depicted a more passive form of co-regulation in which children frequently altered their actions based on observations of their partner during a self-regulation assessment. However, this form of co-regulation was, for the most part, not a result of children's directed efforts to influence one another. Conversely, this study placed children in a scenario in which the explicit goal was to work together to solve as many puzzles as possible in the time allotted. Specifically, the primary research questions focused on whether and how children's co-regulatory behavior during the task was significantly influenced by 1) peer status and 2) regulatory pair type. The sub-questions focused on whether these two factors influenced the success of the group in solving the task. Finally, as with Study 1, the current study was concerned with the ecological validity of a measure previously used to assess one child at a time adapted for use with pairs.

Correlations across all pair conditions suggested several relations between both co-regulation and motivation-related behaviors that occurred during the tangram task. Notably, all four co-regulation variables were inversely related to puzzle score, which immediately signaled that the previously held assumption, that at least *some* co-regulating behavior by children would result in group success, might be incorrect. Additionally, both Verbal facilitative and preventative language during the task were correlated with a number of motivational variables, such as verbal expressions related to ability (e.g., "I/we can't do this"), verbal attributions of lack of success to external factors (e.g., "we need more pieces to do this puzzle"), and verbal information seeking (e.g., "how do we even do this?"). Although the motivation variables were

not a focus of this dissertation, they are nonetheless important to account for, as motivation in early childhood relates to long-term academic achievement, particularly in reading (Berhenke, 2013). Without the motivation to complete the task and engage with a partner, co-regulating behaviors focused on solving a particular problem would be less likely to occur.

In addition to the co-regulation and motivation variables showing strong relations with one another, both physical facilitative and directive co-regulating behaviors were significantly related to academic achievement variables. In particular, physical facilitative direction (e.g., children nonverbally providing their partner – and themselves – with guidance or information to solve the task) was negatively related to reading and math scores, as well as negatively related to teacher-rated reading competency, math competency, and social skills. One of the coded child actions representing this type of co-regulating behavior was handing a partner a piece (as opposed to grabbing it away). It is possible that this is less the result of a child trying to 'facilitate' their partner's involvement than a byproduct of a lower achieving student giving up control to their partner. By contrast, preventative physical direction was somewhat positively related to math scores and teacher-rated math competency. Again, this may be seen initially as a 'negative' co-regulating behavior, in that it prevents another child from completing an action, and appears more forceful. During coding, it was not uncommon for children to grab pieces out of their partner's hand or push their partner's hand or arm away from the puzzle before they themselves could place one of the pieces. From the results, it is logical to conclude that children who were more likely to use Verbal preventative language also exhibited more Physical preventative behaviors. Furthermore, children who used more Verbal facilitative language were less likely to use Physical preventative behavior, perhaps due to a tendency to use verbal communication as opposed to more typically discouraged, physical behavior such as grabbing an

item or pushing another child's hand away. Thus, the verbal and physical preventative co-regulating behaviors tended to occur together, as did the verbal and physical facilitative behaviors. While these results certainly provide a clearer picture of children's interactions during a paired problem-solving task, the results suggest a need to refine the coding system for co-regulating behaviors during the paired tangram task, or similar collaborative problem-solving tasks used to assess the group context. For example, the co-regulating behavior "Physical facilitative direction" may be divided into specific behaviors such as "giving partner a puzzle piece" and "pointing to a spot on the puzzle", despite the idea that they originally seemed to be completing similar goals in giving a partner control with the goal of solving the puzzle in mind. The notion of improving the coding protocol for this assessment will be subsequently discussed.

Impact of Peer Status on Co-Regulation in a Group Context

The results showed that, on average, friends and non-friends did not differ with regard to any of the co-regulating behaviors, although children paired with friends appeared to use more Verbal preventative language than children paired with non-friends. This is likely due to the fact that friends may feel more comfortable using this type of language with one another (e.g., saying "stop", "no", or "don't do that"). Additionally, friends commented more on the difficulty of the task than did non-friends. During the task, pairs were observed "feeding off" one another by discussing the difficulty of the task. In one instance, two friends bantering about how hard the puzzle was made for a humorous scenario:

Child 1: This puzzle is hard.
Child 2: Yeah, you can say that again.
Child 1: (*smiles*) This puzzle is hard.
Child 2: It's just an expression!

The above example illustrates how children could easily impact each other's actions, which may have indirectly impacted overall group performance on the task. In the case of these two children, the comments on task difficulty may have been made in passing, but the friendly interaction between the two led to additional instances of task difficulty being mentioned repeatedly (the exact exchange in the example happened more than once during the trial), which may have an impact on the overall motivation and performance of the students. Additionally, there was a somewhat higher tendency for non-friend pairs to respond that they would rather continue working on an unfinished puzzle than friend pairs. Although this variable was added in as a post-assessment measure to address students' goal-orientation, it may be that friends' increased likelihood of discussing difficulty of the puzzle may have impacted their overall preference in choosing the previously completed ('easier') puzzle. Future research should look specifically at the impact of peer status within a group on motivational outcomes such as these.

Impact of Peer Status on Group Success on the Tangram Task

When having children work together during a problem-solving task, determining how successfully the group members actually worked together is an important step for educators toward understanding how to best enhance student relationships as well as student learning. Oftentimes, evaluating this success takes a more qualitative, anecdotal form (e.g., "These two just don't get along very well" or "I cannot put [student 1] with [student 2] or nothing will get done"). One of the challenges in this study was determining a quantitative measure of "group success" that was not anecdotal. As a result, I created a puzzle score as a measure that reflected pairs' progress in actually solving the task, even if the pair did not completely finish a puzzle, they were rated on how close they came to finishing. While this measure certainly does not necessarily indicate how well children worked together, it nonetheless provides an objective

measure of collaborative achievement. The merits of using such a measure will be discussed subsequently; however, for the purposes of this study, using puzzle score as an outcome variable for 'group success' revealed much about the benefits and limitations of using quantitative methods to assess children's collaborative efforts. The most revealing result was that, on average, non-friend pairs scored significantly higher than friend pairs on task performance, regardless of gender. Regression analyses confirmed this as the strongest predictor after controlling for several other variables. This stands in stark contrast with much of the literature on early childhood peer relationships that discuss the importance of peers as supports. Based on this extensive body of research, I hypothesized that friend groups would perform better on the task, due to the familiarity between pair members having a positive effect on the productivity of the group. However, this study suggests that in an activity such as the tangram puzzle task used here, friends may feel more comfortable engaging in dialogue that may end up indirectly impeding progress (e.g., discussing the difficulty of the task).

Impact of Regulatory Ability on Co-Regulation in a Group Context

The results showed no main effects of regulatory pair type on any of the co-regulating variables. However, there was an interaction effect of peer status by pair type on verbal preventative language. In other words, children that were low-regulated who were paired with a low-regulated partner tended to use less preventative directing language with a friend, whereas high-regulated children paired with a partner that also had high-regulation ability tended to use significantly more preventative directing language, such as telling their partner attempting to complete an action to "stop" or "wait". Finally, there was a tendency for low-regulated children paired with a high-regulated friend to use more preventative directing language. The results showed that girls in the sample were driving this result, which warrants further investigation.

While I had no expectations about the impact of regulatory pair type on specific co-regulating variables, I had expected High/High groups to exhibit the most co-regulatory behavior, on average, regardless of whether they were friend or not.

Impact of Regulatory Ability on Group Success

Due to the established relations between individual HTKS score and math achievement, I had expected groups with at least one high-regulated student (heterogeneous Low/High pairs and homogenous High/High pairs) to have a significantly higher puzzle score than Low/Low homogenous pairs. Results showed that this was not the case. In fact, there were no significant group differences between Low/Low, Low/High, and High/High pairs with regard to puzzle score. This may be a result of the puzzle task not being as closely related to a math task as I had anticipated. Although, for the most part, the task succeeded in both challenging and engaging students for a majority of the eight-minute trials, and represented the type of activity kindergarten students would encounter, the tangram task may not have been as reflective of typical kindergarten math tasks. An activity that more closely mirrored a commonly used kindergarten math task may have led to more separation between pairs regarding puzzle score.

Rather than simply use puzzle score as the only outcome of success, I also examined physical involvement on the task as an outcome. For kindergarteners, being physically involved in that task signifies that children are not simply content to watch their partner have control of whether the group is successful, and are making a conscious effort to participate. Additionally, physical involvement was a significant positive predictor of puzzle score; thus, the primary purpose was to determine what factors influenced this variable as an outcome. A secondary purpose was to help establish whether this task would be feasible for use in future work on this topic. The results showed that being paired with a friend was a negative predictor of physical

involvement overall. Additionally, a significant interaction effect of peer status by pair type showed that high-regulated students paired with a low-regulated friend tended to be less physically involved in the task. This may be a result of friend pairs, overall, being more likely to discuss the difficulty of the task itself and a high-regulated student being more likely to let their low-regulated partner take control of the task for a period of time. Conversely, low-regulated students paired with high-regulated friends tended to be more physically involved in the task, and were less likely to be physically involved when paired with a high-regulated non-friend. Children in Low/High pairs represented the least involved type of student. Not surprisingly, the most involved students were the high-regulated student paired with a low-regulated non-friend. This suggests that within the heterogeneous High/Low, non-friend pairs, low regulated students took on a more passive role within the pair, letting high-regulated students take more of the responsibility or simply disengaging as a result of not being allowed by their partner to help solve the puzzle.

Ecological Validity of Paired Tangram Task

As with Study 1, the current study was concerned with adapting a previously used classroom measure to assess pairs of students. Overall, the tangram task kept students engaged and challenged, as indicated by the high levels of attention and physical involvement within the task, overall. The tangrams were previously all found to be relatively similar in difficulty, but it may be useful for future researchers to use (or create) tangram puzzles that have clear variations in difficulty, so that children start with an "easier" version to maximize the likelihood of early success on the task, and work their way up to more challenging versions. This would also likely increase variations in the number of puzzles that are completed as well as the puzzle score variable. Another alternative may be to give children a specific amount of time to work on a set

number of puzzles. For example, giving pairs two minutes on each puzzle and then scoring each of them on how many pieces were correctly placed at the end may be a way to provide students with more variation and researchers with a more objective measure of puzzle performance, while also minimizing researcher involvement. Although I attempted to make as few comments as possible to the pairs while they completed the tangram puzzles, my mere presence impacted children's actions. For example, children who were more aware of my presence would ask frequent questions to me about the task, rather than communicate with their partner. Also, certain pairs of students would be more likely to try and show me a completed puzzle as quickly and hastily as possible, often with incorrect solutions. This interaction between students and researcher took time away from students focusing on the task itself. In the future, having students work while moving to another part of the room may help maximize the quality of student collaboration.

According to Steiner's (1972) Taxonomy of Tasks, this type of puzzle task would be categorized as a "unitary" task, as opposed to a "divisible" task. Essentially, the tangram task had one primary goal (solving the puzzle correctly) and could not be broken down into subtasks. Additionally, this task optimized quality over quantity, in that there was a particular solution that children needed to arrive at to move on. Finally, the task was "disjunctive" in nature with regard to the interdependence of the group members. This requires group members to determine a single solution for the group. Using this type of task as opposed to other types, such as one that had correct multiple solutions or more defined roles for each child, had important ramifications for the types of behaviors and group dynamics observed in this study. The task-dependent nature of children's interactions will be discussed further in Chapter 6.

Co-regulating Behavior: Helping or Hindering?

This study focused on students' co-regulating behaviors with the belief that certain directed efforts to influence others would stem from a strong, established individual ability to regulate oneself. It seemed logical to predict that because being able to regulate oneself predicts positive outcomes, it also may predict an ability to help regulate others and result in successful group outcomes. In this study, the facilitative behaviors (both verbal and physical) seemed likely to positively influence the pairs' performance on the tangram task. However, the results have largely shown that, the reality is far more complex. In this study, one specific co-regulatory behavior – verbal facilitative language – was a negative predictor of puzzle score. The most contradictory result was that verbal facilitative language positively predicted physical involvement in the task, and physical involvement positively predicted task performance; however, verbal facilitative language negatively predicted puzzle score, controlling for physical involvement. An explanation for this may be that the coding protocol developed for the co-regulating behaviors needs to be refined further, as the variables (as they were coded here) may be capturing other behavioral phenomena. Another explanation is that the facilitative language coded in this study may be a result of an attempt by children to take control of a task, regardless of whether they are categorized as "facilitative" or "preventative," and may subsequently have a more complex impact on the group dynamic. In other words, this tendency of children to exert control in an attempt to regulate others may not be the most beneficial behavior for kindergarteners. Essentially, the umbrella term being referred to as "co-regulatory" behavior in this study may actually be, in a sense, "controlling" behaviors or even "bossiness" in young children. Consequently, it may behoove educators to become more systematic in the types of behaviors they look for when having children work together in pairs. It may be the reality that, at

such a young age, children simply are not very skilled at using their own established regulatory abilities to regulate another child, and that part of the job of educators is to gradually help them develop this skill. It is encouraging that a co-regulating variable (Verbal facilitative direction) predicted physical involvement in the task itself, but this result may simply be a by-product of children that are already more likely to be involved in the task, and that the behavior itself is not necessarily useful or advantageous for working with another child to achieve a particular goal.

Ultimately, co-regulating behaviors at the kindergarten age may not yet be developed to the point that they lead groups of young children to a successful outcome. One example of the most successful pairs observed in this study were two high-regulated boys who were not friends. They exhibited minimal communication between the two of them, but simply worked around each other, placing pieces until each one was used and the puzzle completed. When they reached a point at which the pieces did not fit as arranged, they simply moved pieces until each one fit. All told, they successfully solved six tangram puzzles during the eight-minute trial, and did so with minimal co-regulating behaviors. Multiple coders who viewed the video of these two boys independently commented on how well they worked together, yet the boys barely said one word to each other. While there were likely myriad factors at play in that particular partnership, it is important to further explore what types of partnerships "work" and which do not, and why. Incorporating the teacher perspective on this matter is an important future consideration for work on this topic.

Limitations

There were a number of limitations in this study. As discussed in Study 1, the lack of diversity with regard to socioeconomic status and ethnicity limits the generalizability of these results, as does the low sample size. Future studies must include a larger, more diverse sample in

order to understand how factors such as socioeconomic status and other home environment characteristics may impact the development of co-regulation abilities.

A methodological limitation of this study is that I did not collect individual tangram data from all students in the sample. While the study did include data from 12 students that could not be placed in a pair (due to odd numbers of consent forms within each classroom) for comparison, it would have been useful to compare students' individual behavior with their pair behavior on the tangram task. Time constraints did not allow for this, but this is a clear direction for future work on this topic. Furthermore, the cross-sectional nature of the data makes it difficult to make conclusions about children's development over the course of the school year and beyond. It is crucial that future research on co-regulation within the social context examine the ways in which regulatory ability as well as peer networks change over the course of a year or multiple years.

Another limitation in the study is accurately coding the response variable. In addition to capturing the co-regulating behaviors exhibited by each child, it is important to code for exchanges between children. However, it was particularly difficult to determine what constituted a "response" in many cases. One reason for this was due to the tendency for children to not respond immediately to a partner's co-regulating behavior. We focused our coding only on immediate responses in order to ensure that we could connect the response from one child to the co-regulating behavior of their partner, but delayed responses also occurred. While this variable did not appear to be significantly related to the other variables of interest, this may be a result of not accurately capturing the various types of responses that occurred. Additionally, it would be useful to code instances in which children *do not* appear to respond to their partner's co-regulating behavior (e.g., ignoring). Instances where children's co-regulatory messages (either

verbal or physical) were not successfully transmitted did occur within this study, but were not coded for.

As mentioned, the nature of the tangram task itself is a limitation in this study. The task had a substantial level of ecological validity in that it represented a type of problem-solving task children in kindergarten might see; however, the eight-minute trial time made it a fairly short-term task, which limits the generalizability of the results. The eight-minute trial length was adopted due to the level of variability in behaviors that Berhenke (2013) had previously found using this same task, despite the fact that the previous study used preschool students. In the future, work with kindergarten students might extend the trial time in order to increase the variability of co-regulating and other behaviors.

Finally, the discussion section has already addressed using the puzzle score variable as an objective measure of group success, but that educators often accumulate more anecdotal evidence to support their claims about specific students being better or worse at working with one another. Thus, a limitation with this study is the lack of a *subjective* teacher-rating of how likely they would be to pair the students as they were paired in this study. For example, after determining pairs based on peer status and individual regulatory ability, ask teachers to rate on a scale "how likely would you be to have [Child 1] and [Child 2] work together on a problem-solving task?" and "how likely would [Child 1] and [Child 2] be to successfully solve a puzzle problem together?", as well as why the teacher thought this way. Although Study 3 will address the teachers' perspectives in more detail, having a teacher-rated measure of the likelihood that they would have two specific students from their classroom work together as well as the likelihood of that pair's success would be particularly informative, especially when comparing it to the variables discussed in this study.

Implications

Like Study 1, this study has implications for both researchers and practitioners. Adapting a measure that elicits co-regulatory behaviors among young children yet also keeps students engaged for an extended period of time is useful for researchers to continue building the collective understanding of how children influence each other in a social context. Furthermore, both researchers and educators must be better informed about the types of behaviors to focus on while children are working on typical classroom group activities, and the outcomes of such behaviors. Increasing awareness of what co-regulating behaviors to watch and listen for as well as their possible impact on children's development and learning is information educators may use in their instructional decision-making.

Due to the limitations discussed previously, it is important not to make too many generalizations about these data, including making recommendations for teachers based on a limited sample size. From the results, it may be easy to conclude that friends should not work together on a collaborative problem-solving task, as friends tended to perform worse on the task. Additionally, friends were generally more likely to use preventative directing language with their partners. In videos, being the recipient of verbal and/or physical preventative behavior frequently led a child to "check out" and become disengaged with the task, despite the fact that the two children were rated as "friends" by the teacher (see Figure 4.4). Essentially, if your partner does not let you have any kind of participatory role in an activity, why keep trying to help? Addressing this issue and ensuring that all children within the group are having the chance to participate is likely something teachers already prioritize during these activities. However, providing educators with specific co-regulatory language and actions to observe may provide them with another dimension on which to pair children. Rather than the anecdotal "[Child 1] and

[Child 2] just do not work well together" claim, a more informed, systematic approach may lead to observations such as "[Child 1] is really good at getting [Child 2] to participate" or "[Child 1] usually tries to take over the math game, so [Child 2] has a hard time getting involved." This is not to say that teachers do not already pay attention to such nuances of the social context; indeed, teachers must be aware of the subtleties of each of their students' personalities in order to maximize harmony and productivity within the classroom. The following chapter of this dissertation focuses on teacher awareness of individual students' regulatory abilities and classroom peer networks.

Figure 4.4. Child (left) becomes disengaged with tangram task as a result of partner's preventative directing behaviors.

Future Directions

The current study provided some insight into the ways students interact during a collaborative problem-solving task with the explicit goal of having students work with their partner to finish as many puzzles as possible in a set amount of time. In providing a typical classroom scenario with few guidelines, the tangram task elicited a variety of behaviors, including both expected and unexpected types of co-regulatory behaviors. The unexpected

results of the study, that co-regulatory behavior may not necessarily have a positive impact on young children's developmental outcomes, are important to continue investigating in future studies. Because research examining the social context within the classroom is becoming more widely used (e.g., work by Whitebread and colleagues, 2007 & 2009), work using these methodologies must continue to inform one another as well as educators. Additionally, it would be useful to consider the various perspectives on cooperative learning, as outlined by Slavin (1996). One such perspective, the *social cohesion* perspective, suggests that children are motivated to help one another learn because they care about each other. It would be informative for future work on this topic to include some measure of young children's beliefs about working with others, and whether they feel it is important and why.

One future direction is conducting this study with a longitudinal design. The cross-sectional design of this study makes it virtually impossible to conclude what long-term effects may result from the co-regulatory behaviors observed in the tangram task. If two children remain close friends over a school year or even throughout elementary school, how do their classroom interactions influence each other's development? Furthermore, how do co-regulatory behaviors used by close friends impact children's participation in social contexts throughout school? In Figure 4 above, the child who appears disengaged may continue to have similar experiences if he works with the same partner in various contexts. What if that same child became less engaged with other students on the playground, due to an expectation that s/he would be met with the same resistant co-regulatory behavior?

Another future direction is to vary the activity types so that there is no one specific outcome. In this study, correct (or near correct) completion of the tangram puzzles was used as an outcome. It would be important for future studies to supplement such activities by including

various types of activities that may not have one specific outcome. For example, having children build a structure out of a set amount of materials, and observe how co-regulating behaviors may influence each group's product. This would provide different contexts in which children could exhibit co-regulating behaviors, and would be useful for comparison of those behaviors across activity types.

Finally, future studies should strive to define more types of co-regulating behavior. While this study essentially provided a 2 x 2 (verbal/physical x facilitative/preventative) matrix of the types of behaviors that occurred, there are nuanced co-regulating behaviors that may have gone unaccounted for. It is important that, by collaborating with other researchers and educators alike, studies of children's interactions within the social context continue to refine definitions of co-regulating behaviors in order to ensure that the phenomena that happen in classrooms is being captured by research in educational psychology.

Managing the interaction of multiple children's personalities during each school day is one of the great challenges for classroom teachers. An over-arching impetus for this research was the knowledge that teachers are overwhelmed with the responsibility of accounting for the uniqueness of each child while simultaneously ensuring that the classroom runs as smoothly as possible to maximize learning. In order to combine efforts with educators, researchers must seek the insights provided by teachers and incorporate such insights in order to create systematic research designs that address realistic classroom phenomena. This study was a first step towards accomplishing this, and Study 3 builds off of Studies 1 and 2 by further examining the teachers' perspectives with regard to classroom decision-making.

Appendix E

Tangram Puzzle Task Administration Instructions

The small-group assessment of motivation is a tangram puzzle task for one pair of children and the researcher. The child pair has a different puzzle board made out of felt with a puzzle on the front and back. The teacher does some brief modeling (see instructions below) and then the children work with a partner to solve the puzzle for eight minutes. After eight minutes, the researcher(s) helps children fit in two of the key pieces so that they are able to finish successfully on their own. The task is videotaped from beginning of instructions until the last child finishes.

Researcher Script with instructions

- Today, we are going to be working with puzzles.
    - You are both going to get a puzzle
    - You are both going to get a baggie with seven puzzle pieces
- You have big pieces and little pieces in your bag
    - Start with the two biggest pieces (this makes the puzzle easier)
    - Put the blue pieces on top of the yellow part
    - Cover up all the yellow
- I'm going to show you first
    - *Model placing the first big triangle correctly*
    - *Model placing the second big triangle so it overlaps*
        - Is this right? (*No.)*
    - *Model placing the second big triangle so it's hanging over the edge*
        - Is this right? (*No.*)
    - Make sure your pieces go next to each other and don't hang over the edge. Make them fit nicely like this.
    - See how all the yellow is covered up?
- Work together and try the best that you can to figure out where the pieces go
    - Sometimes you need to flip them and turn them
    - Remember to start with your two biggest pieces!
    - I'm just going to watch you
- *Give out puzzle pieces.*
- *Let students work for eight minutes, giving mild reassurance and encouragement when needed.*
- *After eight minutes or so, help students find where their big triangles go so they can finish successfully.*

Appendix F
Tangram Coding Protocol

On and Off-Task Behavior, General Level of Engagement During Task
Please record the start and stop time to indicate the duration of each behavior

On-Task Behavior: Child's attention is on the puzzle task, on their partner (as long as the partner is attending to the task), or on the experimenter (as long as it is regarding the task itself, such as asking a question about the puzzle).
Examples: Child is actively manipulating puzzle pieces, directing partner on where to put a certain piece, watching partner's action

Off-Task Behavior: Child's attention is not on the puzzle task for a minimum of at least three seconds (use your discretion). Speaking to the experiment can be considered "off-task" if the child is complaining or otherwise not attempting to persist in completing the puzzle.
Examples: Staring off at something or someone else in the room, playing around with puzzle pieces (not attempting to complete task), whining/complaining to experimenter, etc.

Note: On and Off-Task behaviors will mainly be determined by where the child appears to be looking

Engaged in Puzzle Task: This is to indicate when a child is holding a piece of the puzzle and is actively engaged in the completion of the task.
Note: This is to differentiate "On-Task" (e.g., child looking at partner while partner does most/all of the work completing the puzzle) vs. taking a more active role in the puzzle completion.

Verbal Behavior (Note: Continue on another page if needed)

Phrase Types:
Facilitating Direction – Increases behavior/provides information ("That goes there", "He said start with the two big pieces")
Preventative Direction – Decreases behavior ("No, that doesn't go there", "Don't put that there")
Frustration – Expressing irritation/helplessness at difficulty of task ("It's hard", "We can't do this", "We give up")
Expectation of Success – Child expresses expectation that they will succeed in the task (e.g., "This is going to be easy", "We're going to do this so fast!")
Pride/Excitement – Expressing positive emotions about the task ("Yeah! Yeah! That goes there!", "We did it!")
Persistence – Expressing encouragement or a desire/effort to continue working ("We can do this!, "Let's try another way")
Attribution – Finding fault with the puzzle itself ("We don't have enough shapes, "The pieces don't fit", etc.)
Other – Any verbal expression that is not covered by the previous categories, such as inaudible whispering, singing, noises, etc. (Note: you must add a comment for behavior you categorize as "Other")

Behaviors that are in response to partner:
- Child directly responds to a partner's question/comment (not imitating)

Behaviors that are imitating partner:
- Child directly imitates partner's speech/phrase

Physical Behavior (Note: Continue on another page if needed)

Action Types:
Facilitating Direction – Increases behavior/provides information (e.g., Handing piece to partner, pointing to a specific spot for partner to place one of the pieces)
Preventative Direction – Decreases behavior (e.g., Physically preventing partner from putting a piece in a specific place such as grabbing the piece itself, or pushing a partner's arm/hand away)

Frustration/Disengagement – Expressing irritation/helplessness at difficulty of task (slumping in chair, sitting back and not engaging with task – may coincide with off-task behavior)
Pride/Excitement – Expressing positive emotions about the task (smiling, laughing, clapping as a result of progress on puzzle)
Other – Any physical expression that is not covered by the previous categories, such as getting out of chair, flailing arms or excessive fidgeting, etc. (Note: you must add a comment for behavior you categorize as "Other")

Appendix G
Tangram Coding Sheet

Coder Initials: _____ Date: _____
Child ID: _____Partner ID: _____ Group ID: _____
Trial Time Start in Video: ___ : _____ **Trial Time End in Video: ___ : _____**
On and Off Task Behavior (Note: you may not need to fill in table, depending on child. Continue on another page if needed.)

Attention	Off-Task	Physical Involvement
__:____to__:____	__:____to__:____	__:____to__:____
__:____to__:____	__:____to__:____	__:____to__:____
__:____to__:____	__:____to__:____	__:____to__:____
__:____to__:____	__:____to__:____	__:____to__:____
__:____to__:____	__:____to__:____	__:____to__:____
__:____to__:____	__:____to__:____	__:____to__:____
__:____to__:____	__:____to__:____	__:____to__:____
__:____to__:____	__:____to__:____	__:____to__:____
:____to__:____	:____to__:____	:____to__:____
__:____to__:____	__:____to__:____	__:____to__:____
:____to__:____	:____to__:____	:____to__:____
Total Time (sec):	**Total Time (sec):**	**Total Time (sec):**

Verbal Behavior (Note: See coding information sheet for specific phrase types. Continue on another page if needed.)

	INDIVIDUAL	SOCIAL		
Child Phrase Type	**Count (tally)**	**# in Response to partner (tally)**	**# Imitating Partner (tally)**	**Comments**
Directing (+)				
Directing (-)				
Task Difficulty				
Ability				
Pride/Excitement				
Expectation of Success				
Persistence				
Attribution				
Information Seeking				
Other (need comment)				

Physical Behavior (Note: see coding information sheet for specific behavior types. Continue on another page if needed.)

Child Phrase Type	Count (tally)	# in Response to partner (tally)	# Imitating Partner (tally)	Comments
Directing (+)				
Directing (-)				
Frustration/ Disengagement				
Pride/Excitement				
Other (need comment)				

Puzzle 1 Progress:	**0 (did not solve)**	**1 (majority solved: 4/7 pieces)**	**2 (successfully solved)**
Puzzle 2 Progress:	**0 (did not solve)**	**1 (majority solved: 4/7 pieces)**	**2 (successfully solved)**
Puzzle 3 Progress:	**0 (did not solve)**	**1 (majority solved: 4/7 pieces)**	**2 (successfully solved)**
Puzzle 4 Progress:	**0 (did not solve)**	**1 (majority solved: 4/7 pieces)**	**2 (successfully solved)**
Puzzle 5 Progress:	**0 (did not solve)**	**1 (majority solved: 4/7 pieces)**	**2 (successfully solved)**

Experimenter Comments (tally):

Information:	Encouragement:

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CHAPTER FIVE

Study 3: Teacher Perceptions of Regulatory Ability and Peer Connections in the Classroom

Introduction

To this point, Studies 1 and 2 have examined how peer status and regulatory ability impact co-regulation behaviors among pairs of kindergarteners. Study 3 investigated whether the reality of student regulatory abilities and peer networks matched teacher perceptions. Specifically, the current study was concerned with how teachers think about these factors in the classroom, how their instructional-decision making reflects their beliefs, and how accurate they were with regard to rating children's self-regulation abilities and peer connections. As mentioned in Chapter 2, there is an increasing focus on peer ecologies in the classroom and the ways in which these may help determine classroom outcomes (e.g., Gest & Rodkin, 2011; Gest et al., 2014). In addition, there is a great deal of literature that examines teacher awareness of classroom peer connections, particularly with regard to "well-liked" and "rejected" students (e.g., Gronlund & Anderson, 1957; Cadwallader, 2000). This study builds on the existing literature by integrating data on children's regulatory abilities and their peer connections with the practitioner perspective. The central premise of this study is that teachers' decisions have both indirect and direct influences over developmental and academic outcomes in the kindergarten classroom, and these decisions are affected by what teachers' believe about their students. The primary research questions for this study were:

- Regarding peer connections and children's regulatory abilities, how closely do teacher perceptions relate to the classroom reality?
    - What factors do kindergarten teachers consider most important when making decisions about how children will interact in the classroom on a daily basis (e.g., seating charts, group work), and how closely do actual seating charts reflect their beliefs?
    - How accurate is the match between teacher perceptions and student perceptions of peer connections in the classroom?
- What types of activities and strategies do teachers use to facilitate regulatory strategies within the classroom?

The first research question and sub-questions are quantitative in nature, and compare teacher variables to the student performance variables described in Studies 1 and 2. The second research question concerns qualitative aspects of teacher decisions in the classroom and examines: (a) the level and types of awareness that teachers have about their students, and (b) the strategies they use to facilitate regulatory abilities of their students. An additional, yet secondary goal of the study is to establish teachers' receptivity to learning more about how these factors influence their classroom dynamics.

Hypotheses

Generally, I did not have specific hypotheses about teacher responses, except that they the majority would indicate that they use group activities with students in the classroom, and that most teachers would likely express a high awareness, overall, of their students' regulatory

abilities and peer connections in the classroom. Further, I expected that most teachers would respond that they did not collect specific data on either their students' regulatory skills or their peer connections. In keeping with the work by Gest and Rodkin (2011), I believed teachers would consider separating behavior problems to be the most important factor and reinforcing existing friendships to be the least important factor when deciding how to group students in the classroom. I had no specific hypotheses regarding teacher accuracy in correctly identifying friendships (as compared to student nominations), though previous research indicating that many teachers have a poor understanding of classroom friendship patterns (Gest, 2006; Pearl, Leung, Van Acker, Farmer, & Rodkin, 2007) led me to predict that teacher accuracy would be low (below 50% overall). Finally, I expected that teachers would indicate that they used a variety of methods in the classroom to facilitate regulatory strategies in the classroom.

Method

Participants

Participants in this study included 11 kindergarten teachers from four different elementary schools in Southeastern Michigan. All of the teachers were female and Caucasian. Across the sample, the mean number of total years of teaching experience was 12.54 (range = 2 to 28 years). The mean number of years of teaching experience in kindergarten was 5.45 (range = 2 to 14 years). The mean class size was approximately 25 students. All teachers had achieved their Bachelor's degree through a traditional teacher education program, as opposed to an alternative certification program. In addition to their bachelor's degree in education, nine (82%) of the teachers had achieved a Master's degree, with concentrations typically focused on elementary education, literacy, and curriculum, although one teacher had attained a Master's degree with a counseling focus.

Procedure

As the current study was part of a larger research project that incorporated data from Studies 1 and 2, it shares measures with the other studies. For example, as described in Chapter 3, teachers completed peer nomination sheets in which they indicated each child's three 'best friends' in the classroom. This information was then used to pair children for the paired activities. Teachers also completed rating scales of students' reading competency, math competency, social skills competency, as well as children's regulatory skills (e.g., working memory, attention, and inhibitory control). The current study included administering a teacher survey (see Appendix H) and collecting seating chart data for each class (see Appendix I). These measures are described in detail in the next section. Teachers completed the survey at their convenience following the completion of student data collection in their classrooms. Seating charts were noted at the time student data were being collected. These were obtained only after asking teachers whether they used seating charts, and if so, whether the current seating chart had been in place for at least two weeks to ensure that group dynamics had been established between students at their tables. Although all teachers used a seating chart, eight of the 11 classroom teachers had a seating chart that had been in place for at least three weeks, whereas the other three teachers had either just recently changed the seating chart in the week prior to data collection or had instituted a more flexible seating chart near the very end of the school year in mid to late May (e.g., children chose their own seats on a daily or weekly basis as an end-of-year "reward").

Measures

Teacher Survey. The survey asked teachers questions regarding their classroom environment (e.g., "Do you have a seating chart in your classroom?" and "How are the seats

arranged in your classroom?"). The survey followed up with questions asking teachers to rate the importance of each of several considerations when creating seating charts and grouping students in the classroom, adapted from a measure used by Gest and Rodkin (2011). Teachers were asked to "Please rate how important each of the following considerations were when [creating the seating chart/group]." Each consideration was rated on a 5-point Likert scale with response options ranging from *Not at all important* (= 1) to *Somewhat important* (= 3) and *Very important* (= 5). Two of the items addressed academic considerations: "To place students together who have diverse skill levels" and "to place students together who have similar skill levels". Two items addressed friendship considerations: "to place children together with others who are not yet their friends (e.g., to promote new friendships and social connections)" and "to place children together who are already friends (e.g., to respect student preferences and/or reinforce those friendships)". One item described a behavior management consideration: "To separate students who might pose behavior problems if they were in the same group." One item addressed gender: "To place students of different genders together", and another addressed race/ethnicity: "to create groups with racial/ethnic diversity." Finally, one item addressed students with special needs: "To accommodate the special needs of specific individual students (e.g., vision problems, special educational or behavioral challenges).

Additionally, the survey asked teachers whether children regularly engage in classroom activities in which they are supposed to be working in pairs or groups and if so, what types of activities and how frequently they occurred during a typical school day. The survey also asked teachers about their awareness of children's regulatory abilities. Specifically, the survey asked teachers to provide examples of children regulating one another, as well as examples of what student actions preceded successful/unsuccessful group work. The survey asked teachers about

their awareness of peer connections in the classroom, as well as how this influences their instructional decision making (e.g., "If you collect information on social connections in the classroom, do you use it to inform classroom decisions? If so, how?"). Teachers were provided with several options, including an open-ended "Other" option and were encouraged to "check all that apply". Teachers who responded that they did not use such information were asked whether they would use such information, and if so, in what ways. Finally, the survey asked teachers about the types of specific strategies teachers used in order to foster behavioral and emotional regulation within the classroom, and provided them an opportunity to add any additional comments.

Classroom seating charts. At the time student data were collected, seating charts of the classroom were mapped out so that students' assigned seats in the classroom reflected exactly how they were arranged at the time of the study. Seating charts included the general layout of the classroom, including the student tables, carpet area, teacher's desk, and main entrance to the room. All classrooms in the study had students seated at tables, rather than individual desks, with an average of five tables per classroom, and approximately five children per table.

Results

Descriptive Statistics

In order to provide a contextual snapshot of the schools and classrooms in this study, Table 5.1 presents descriptive statistics for the teachers, and their classroom averages with regard to student data collected for Studies 1 and 2. The table includes the total number of years of teaching experience, years of kindergarten teaching experience, and the number of participants in the study as well as the proportion of the entire class included in the study. Additionally, the

table shows student means for individual Head-Toes-Knees-Shoulder score, paired HTKS score, Woodcock-Johnson Letter Word Identification score, and W-J Applied Problems score. The table illustrates trends among the mean student scores between classrooms. Between individual and paired HTKS score means, three classrooms went from a below average individual HTKS score to an above average paired HTKS score. Two classrooms showed the opposite trend, with students in each class scoring above average on individual HTKS and below average on the paired HTKS. Four classes scored below the sample mean for both individual and paired HTKS scores. Finally, two classes scored above the sample mean for both individual and paired HTKS scores. Among Woodcock-Johnson scores, all classes who scored above or below the sample mean did so for both assessments.

Notably, the schools differed significantly with regard to their average levels of mother education, the proxy variable for socioeconomic status in this study. Mothers of children from schools 1 and 2 had completed, on average, some college but not attained a degree. Mothers of children from schools 3 and 4 had, on average, completed at least a bachelor's degree. A school-level variable was created to reflect this, so that 0 = *Low SES* and 1 = *High SES.* Table 1 shows that, with the exception of one classroom average paired HTKS score, classes from schools 1 and 2 performed below average on both regulatory and achievement variables. Regarding demographic factors, an independent samples T-test showed that schools differed on the amount of students per classroom, $t(9) = 5.99$, $p < .001$. On average, low SES schools had 27 ($SD = .96$) students per classroom, whereas high SES schools had 24 ($SD = .82$) students per classroom. In high SES schools, students were significantly older, with students averaging 74.2 months ($SD = 1.02$), whereas students in low SES schools averaged 71.3 months ($SD = 1.28$). Regarding student performance scores, T-tests showed that the two high SES schools were higher than the

two low SES schools on individual HTKS score, $t(9) = -2.19$, $p = .06$, and significantly higher on both Letter Word Identification, $t(9) = -5.44$, $p < .001$, and Applied Problems score, $t(9) = -7.15$, $p < .001$. This information was not part of the primary research questions, but rather, provides a context with which to consider the schools within the study. It also establishes classroom patterns with regard to students' regulatory and academic abilities.

Table 5.1. Descriptive statistics for classroom demographics and student performance variables.

Teacher Number	**School**	**Years teaching Total (K)**	**Participants in Study (% of class total)**	**Average Ind. HTKS Score**	**Average Paired HTKS Score**	**Average W-J LW Score**	**Average W-J AP Score**
1	1	11 (2)	8 (31%)	39.3	45.0	20.0	20.8
2	2	28 (14)	21 (75%)	36.5	43.9	21.8	20.4
3	2	6 (4)	13 (46%)	39.3	45.1	22.1	20.2
4	2	7 (3)	10 (37%)	39.5	47.6	21.1	20.3
5	3	6 (2)	15 (63%)	47.8	49.8	27.9	22.9
6	3	2 (2)	14 (61%)	40.9	53.6	26.9	22.4
7	3	22 (2)	19 (79%)	43.4	46.4	24.7	22.9
8	3	10 (10)	10 (42%)	38.1	45.0	25.8	22.3
9	3	7 (4)	13 (57%)	39.5	48.2	30.1	24.4
10	4	14 (14)	17 (68%)	43.3	47.8	26.0	23.6
11	4	25 (3)	9 (36%)	45.0	45.6	25.3	23.2
Means		12.5 (5.5)	13.5 (54%)	41.1	47.1	24.7	22.1

= above sample mean = below sample mean

To begin addressing the first research question, Table 5.2 presents the means, standard deviations, and ranges for each of the eight items on the grouping strategy rating scale. Teachers in this sample described separating behavior problems, accommodating special needs, and creating gender diversity as strong considerations. Promoting new friendships, promoting academic homophily, and promoting academic diversity were also moderate to strong considerations. Teachers generally placed the least emphasis on creating racial/ethnic diversity and reinforcing existing friendships. Notably, independent samples *t*-tests showed that teachers from low SES schools and high SES schools significantly differed with regard to their beliefs on two of the scale items. Teachers from low SES schools ($M = 4.50$, $SD = .58$) were more likely to place importance on seating children with similar skill levels together than teachers from high SES schools ($M = 2.71$, $SD = .49$), $t(9) = 5.49$, $p < .001$. Additionally, teachers from low SES schools ($M = 3.00$, $SD = .82$) were more likely to place importance on reinforcing existing friendships than teachers from high SES schools ($M = 1.71$, $SD = .76$), $t(9) = 2.64$, $p < .05$.

In addition to the eight items listed in Table 2, there was an additional "Other" item for teachers to write in an open-ended response that they felt had not been captured by the items provided. Only one teacher added her open-ended response: "I tend to place children based on their ability to listen/follow instructions." A follow-up conversation revealed that her response referred to her tendency to keep students who have a more difficult time listening and following instructions within a closer proximity (e.g., closer to her desk, nearer to her during carpet time, etc.).

Table 5.2. Descriptive statistics of teacher attitudes regarding grouping strategies.

Teacher-rated grouping strategies	**Mean (SD)**	**Range**
Promote new friendships	3.27 (.90)	2-5
Reinforce existing friendships	2.18 (.98)	1-4
Promote academic homophily	3.36 (1.03)	2-5
Promote academic diversity	3.27 (1.01)	2-5
Separate behavior problems	4.91 (.30)	4-5
Create gender diversity	4.18 (.75)	3-5
Create racial/ethnic diversity	3.00 (.63)	2-4
Accommodate special needs	4.55 (.52)	4-5

In addition to mean scores for each item, relations between teacher-reported grouping strategy items were established using partial correlations, controlling for average mother education, and each teacher's number of years of total experience (see Table 5.3).

Table 5.3. Partial correlations between teacher-reported grouping strategy items.

	Promote new friendships	Reinforce existing friendships	Promote academic homiphily	Promote academic diversity	Separate behavior problems	Create gender diversity	Create racial/ethnic diversity	Accommodate special needs
Promote new friendships	--							
Reinforce existing friendships	.54	--						
Promote academic homiphily	.44	.01	--					
Promote academic diversity	-.45	.17	-.12	--				
Separate behavior problems	-.40	-.87**	.10	-.23	--			
Create gender diversity	-.16	-.37	.19	-.59^{t}	.26	--		
Create racial/ethnic diversity	.40	.80**	.31	.33	-.67*	-.40	--	
Accommodate special needs	.25	-.03	.08	-.70*	.13	.57^{t}	-.05	--

Note. N = 11. ^{t} < .10, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 5.3 shows several notable relations between items. First, teachers who were likely to place a greater importance on reinforcing existing friendships with their grouping strategies were less likely to place as much importance on separating behavior problems (r = -.87, p < .01), and more likely to place importance on creating racial/ethnic diversity (r = .80, p < .01). Second, teachers that placed a higher importance on promoting academic diversity were somewhat less likely to place importance on creating gender diversity (r = -.59, p < .10), and significantly less likely to place importance on accommodating special needs (r = -.70, p < .05). Third, teachers who found separating behavior problems to be more important were less likely to emphasize creating racial and ethnic diversity with their seating charts (r = -.67, p < .05). Finally, teachers that placed a higher importance on creating gender diversity were somewhat more likely to focus on accommodating special needs (r = .57, p = < .10).

To focus on the sub-question regarding how closely classroom seating charts reflected teacher beliefs about peer connections, I examined seating charts and compared them to teacher nominations of "best friends" among students participating in the study and determined how many teacher-nominated best friends each child had at his or her table. Partial correlations controlling for the number of children in each classroom and the number of years of teacher experience showed no significant relations between how many friends were sitting together at a table and the two items from the teacher-reported grouping attitudes scale (*Promote new friendships* or *Reinforce existing friendships*).

To address which factors teachers may consider when deciding whether to group friends together, I examined relations between seating chart patterns with several student variables. Because the vast majority of children who sat near a "best friend" only had one such friend at their table, I coded the variable as 0 = *No,* and 1 = *Yes* with regard to the variable "*has at least*

one friend at their table." Results indicated that students were almost equally likely to be at a table with zero friends as with at least one friend, according to the teacher nominations (49.6% with at least one friend). Table 5.4 shows this variable correlated with both demographic factors and individual child scores.

Table 5.4. Correlations between demographic/achievement variables and whether children sat near a friend.

	Gender (Girl=1)	Age	Mother Ed. Level	Teacher Years of Exp. (K)	W-J LW Score	W-J AP Score	Ind. HTKS	Paired HTKS	T-R Self-reg.	T-R Acad. Comp.
Seated near ≥ 1 friend (T nom.)	.16^{t}	.02	.12	-.11	.03	.10	.19*	.17^{t}	.04	.02

Note. N = 117 due to incomplete seating chart data. ^{t} $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 5.4 shows that teachers were somewhat more likely to place girls at a table with at least one friend ($r = .16$, $p < .10$). Additionally, children being seated at a table with at least one friend was significantly related to individual Head-Toes-Knees-Shoulders scores ($r = .19$, $p < .05$), and related with paired HTKS score ($r = .17$, $p < .10$), although this relation was not significant. This indicates that children's regulatory ability was related to whether they were assigned to sit at a table with at least one other child the teacher considered to be a close friend. A follow up *t*-test confirmed that children seated with at least one close friend at their table ($M = 43.95$, $SD = 10.86$), and students who did not ($M = 38.93$, $SD = 15.04$) significantly differed with regard to their individual HTKS scores, $t(114) = 2.05$, $p < .05$. These groups, however, did not differ on other achievement factors, such as Woodcock-Johnson Letter Word or Applied Problem scores, nor did they differ on teacher-rated self-regulation or academic competency variables.

When comparing whether children had at least one teacher-nominated best friend at their table to whether they had one *student-nominated* best friend at their table, it is clear that there are differences between teacher and child perspectives of peer networks in the classroom. According to student nominations of best friends, children were less frequently seated at a table with one of their close friends (39.7% with at least one friend). This represents an approximately 10% decrease in the likelihood of friends sitting together when comparing the teacher perspective to the student perspective.

To examine the sub-question of how accurate teachers perceptions of close friends in the classroom were with student perceptions, teachers were given a score of 0-3, indicating whether they correctly identified 0, 1, 2, or 3 of each child's closest friends, based on children's responses. For the 149 students in the sample, the teacher/student peer matching scores are as follows: *0 matches* – 15 students (10%), *1 match* – 53 students (35%), *2 matches* – 59 students (40%), and *3 matches* – 22 students (15%). Table 5.5 shows the total number of correct individual matches each teacher had, as well as the total possible, and the percent correct. There was no discernable teacher variable that accounted for why some teachers had a higher percentage of correct peer matches. In particular, neither teachers' total years of experience nor years teaching kindergarten were significantly correlated with percentage correct.

Table 5.5. Correct peer matches by teacher.

Teacher	School	Correct	Possible	Percent Correct
1	1	11	24	46%
2	2	45	63	71%
3	2	24	39	62%
4	2	13	30	43%
5	3	18	45	40%
6	3	28	42	67%
7	3	25	57	44%
8	3	15	30	50%
9	3	16	39	41%
10	4	23	51	45%
11	4	15	27	56%
			Sample Mean:	52%

After establishing teachers' accuracy with regard to identifying their students' closest friends, a follow-up comparison was conducted between student nominations and teacher nominations. As mentioned above, teacher variables (e.g., years of experience) did not account for how accurate they were in identifying children's closest friends. Thus, I investigated the question of what *student* factors may be influencing which children both peers and teachers were nominated the most within their classrooms. After calculating how many times each student was nominated as a "best friend" by both students and teachers, I conducted a partial correlation controlling for the number of years of teacher experience and the number of students in the classroom. Table 27 shows the relations between the number of (both peer and teacher) nominations and children's performance variables, including self-regulation, Woodcock-Johnson scores, and teacher-rated academic competency and regulatory skills.

Table 5.6. Correlations between peer nominations and student variables.

	Gender	Age	W-J LW Score	W-J AP Score	Ind. HTKS Score	T-R Reading Comp.	T-R Math Comp.	T-R Social Skills	T-R Inhibitory Control	T-R Attention	T-R Working Memory
Peer Nominations (student)	.13	.07	.23**	.23**	.15^{t}	.36***	.33***	.40***	.15^{t}	.21*	.17*
Peer Nominations (teacher)	.02	.14	.10	.18*	.11	.17*	.19*	.18*	.07	.04	.09

Note. N = 149. ^{t} $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 5.6 shows several relations between the number of peer nominations students received and individual student characteristics. However, there were more significant correlations with peer nominations and student variables than with teacher nominations. The number of times students were nominated as "best friends" by their peers was significantly related to both Woodcock-Johnson Letter Word ($r = .23$, $p < .01$) and Applied Problems ($r = .23$, $p < .01$) scores, as well as several teacher-rated variables. Correlations were strongest between student nominations and teacher-rated reading competency ($r = .36$, $p < .001$), math competency ($r = .33$, $p < .001$), and social skills ($r = .40$, $p < .001$). Correlations between student nominations and teacher-rated attention ($r = .21$, $p < .05$) and teacher-rated working memory ($r = .17$, $p < .05$) were significant correlations, while the relation between student nominations and teacher-rated inhibitory control was not significant ($r = .15$, $p < .10$). Finally, there was a relation between student nominations and individual Head-Toes-Knees-Shoulders score ($r = .15$, $p < .10$) although again, this relation was not significant. Conversely, there were fewer correlations between teacher nominations and student variables. Number of teacher nominations was significantly correlated with Applied Problems scores ($r = .18$, $p < .05$), teacher-rated reading competency ($r = .17$, $p < .05$), math competency ($r = .19$, $p < .05$), and social skills ($r = .18$, $p < .05$).

Qualitative Results: Group Activities

In addition to determining the factors that teachers consider most important when making instructional decisions on grouping activities, as well as how accurate teachers were regarding their awareness of peer networks in the classroom, another central goal of this study was to establish classroom trends among teachers in the sample with regard to their pedagogical decisions. Particularly, this research question was concerned with learning more about what types of group activities occur in a typical classroom, how teachers identify common student

characteristics that lead to successful and unsuccessful group work, and what strategies teachers use to facilitate regulation among their students. As mentioned previously, all teachers in this study used a seating chart for the majority of the school year, and all teachers had students complete multiple group activities throughout the school day. Table 5.7 depicts the types of group activities that occurred during the typical day, approximately how many times they occurred on average across the sample, and several examples of each activity type.

Table 5.7. Types of group activities occurring during a typical kindergarten school day.

Group Type	Average occurrences per day	Examples of Activities
Pairs	3-4	Turn and talk, partner reading, math games, literacy centers/stations, think-pair-share, writer's workshop
Small Group (3-4 students)	2-3	[Teacher-led] small group instruction, literacy centers/stations, math or other group games, play time
Large Group (5-7 students)	1-2	Free choice/explore time [play], mini-lessons, team building, art projects, table activities
Whole Class	4-5+	Whole group instruction, morning meeting, read aloud, math instruction, group writing

A common trend for teachers was to indicate that pair work and whole class work occurs most frequently in their classrooms. For paired activities, teachers often cite 'turn and talk' or 'think-pair-share' activities as common practices. These typically happen during carpet time and encourage children to speak to a neighboring child about a specific topic, usually provided by the teacher. This provides children an opportunity to 1) develop social skills with their classmates, 2) think about what they just heard and speak about it with a peer in their own words, and 3) have a bit of a break from direct instruction from the teacher. Teachers' examples of small group activities commonly focused on teacher-led small group instruction, such as guided reading

lessons, and literacy or math centers. These centers often require students to work with others for 15-20 minutes on a targeted activity and then rotate to another activity. Teachers indicated that there are typically three to four rotations within "center time". Children usually remain in the same groups for several weeks and complete activities that teachers' have deemed necessary to fit their learning needs. However, teachers explained that these small groups are flexible, depending on student progress. Examples of large group activities were less varied. These typically included examples of free choice play time, or less specific examples of table activities. Of the four pair types, teachers appeared to institute large group activities the least, and two of the teachers indicated that they do not have large group activities at all. Several teachers indicated that, for the sake of classroom management, children working together in groups greater than five (approximately the amount of children per table in the sample) is rare during the school day. Finally, whole class instruction appeared to be the most common. This frequently includes having children transition to a designated area, typically a carpet for children to sit and listen to instruction. Teachers cited whole class activities that included morning meeting (a routine activity to begin the day), read aloud time, or whole group instruction.

In addition to the types of group activities as well as their frequency, the survey asked teachers about the typical characteristics children exhibit during successful and unsuccessful group work. The question "*What (student actions) do you notice are happening when students work well together?*" was fairly open to interpretation, depending on how teachers defined the phrase "work well together". Teachers tended to respond with child behaviors typical of students with high behavioral regulation, such as taking turns, sitting in an appropriate manner (i.e., side by side), talking at correct voice levels, talking respectfully to one another, listening to one another, and being on task. Some teachers were more specific in their expectations of successful

group work. For example, one teacher indicated she wanted students to "help teach each other using language" and expected them to be "comfortable with their partner so that they take risks when working together." Another teacher identified specific verbal exchanges between students that she expects to hear, including "using proper words to communicate to each other, (e.g., 'I like your idea', 'We could also do this', 'Please pass [an item]')." Another teacher took the opportunity to respond with her belief about what types of partnership she felt works best: "students tend to work best when placed in mixed level groups and not with students they are too friendly with. Boy/girl groups are often good also."

Conversely, the survey asked teachers about characteristics of unsuccessful groups with the question "*What (student actions) do you notice are happening when students do not work well together?*" Teacher responses commonly included child behaviors typical of students with low behavioral regulation, such as disrupting classmates, off-task/fooling around, loud voices, whining, arguing, tattling, and crying. A few teachers provided more specific responses focused on students' inability to handle the task on their own, such as "missteps in directions" and "materials spilled or lost". Finally, two of the teachers provided specific responses that focused on the breakdown of the group dynamic during a group activity: "learning is not taking place due to high frustrational levels of the children in the pair", "one person dominating," and an example of "one [child] is goofing around, the other is upset that work is not getting done".

The survey followed up by specifically asking teachers whether they observed students regulating, or attempting to regulate, their peers during group activities with the question "*During group/partner work, do you observe students exhibiting behaviors that help regulate their peers?*" Teachers were then prompted to describe a least two such behaviors. Of the 11 teachers, 10 answered that they observed student behaviors that indicate they help regulate their

peers. The teacher who responded "No" also added, "Most kids do not try to regulate peers aside from tattling." Among the teachers who responded "Yes", a variety of examples for co-regulatory behaviors were given. Common responses included students reminding their partner of the correct behaviors or task directions (often using teacher-modeled behaviors and phrases to do so), being a "helpful friend" by using kind words or "friendly reminders", and attempting to keep a partner on task before getting the teacher involved as a last resort. More specific responses included: "expectations are modeled by students which help peers that are off task", and "use of non-verbal gesture to help remind [partner] to be quiet". Finally, one teacher suggested a desirable partner dynamic: "a student who can be off task when working with a friend does a better job of staying on task with someone else. Students who work well independently are able to help struggling students stay on task."

The last survey question regarding student-related behaviors asked teachers to think of one student in their class that they considered a "*leader*" or, more specifically, a student that is "*more capable of making sure a group is on task*." This question was intended to elicit responses that identified characteristics of children who might exhibit more "co-regulating" strategies in the classroom or, at the very least, inspire less-regulated children to mimic expected behaviors. Teacher responses tended to include individual-level behavioral expectations for young children, such as listening, following directions, following classroom rules, sharing, talking at correct voice level, and doing their best work. Similarly, teachers provided individual student personality characteristics, including having "a strong personality or high confidence level", as well as being "assertive" and "focused". These responses appeared to focus on individual qualities of leaders in the classroom, rather than on their skills in co-regulating other children. A few teachers responded with more detailed examples that suggested co-regulating abilities, such

as: "[child] can resist temptation of joining in and making poor choices with another student", "likes to organize the tasks of the group", "helps peers if they are unsure of what to do", and "will follow all directions and get others to do the same."

Qualitative Results: Teacher Awareness

The survey then focused on teacher awareness of peer networks and children's regulatory abilities in the classroom. The first question asked whether teachers have a sense of the social connections in the classroom and if so, what methods teachers used to get a sense of the social connections. Teachers were given the opportunity to check all of the following that applied: 1) *Daily observations*, 2) *Conversations with students*, 3) *Conversations with other adults (e.g., parents or other educators)*, 4) *Student work* (*e.g., writing or drawing)*, 5) *Specific data (e.g., asking students directly about preferences and keeping track of this information*. Teachers were also provided with an "Other" category and asked to specify an alternate method. All eleven teachers responded that they believed they had a sense of the social connections in the classroom. When asked to include the methods they used in obtaining this information, eleven of the teachers (100%) indicated they used daily observations (100%), eleven (100%) used conversations with students, seven (64%) used conversations with other adults, seven (64%) used student work, and no teachers used specific data. No teachers specified an alternate method for the "Other" category.

Teachers were then asked whether and how they use information on social connections to inform classroom decisions. Six teachers (55%) indicated that they do, one (9%) indicated that she did not, and four (36%) indicated that this was not applicable to them. Of those who responded "Yes" to this question, a follow up question asked them to identify the ways in which they use information on classroom social networks. Again, teachers were asked to check all of

the following that applied to them: 1) *Classroom seating arrangements*, 2) *Group work*, 3) *Facilitating new social connections among students*, 4) *Determining which students are viewed as most/least desirable to play with*, 5) *Determining which students are viewed as most/least desirable to work with*, 6) *Assigning classroom responsibilities (e.g., job chart)*. Teachers were again provided with an "Other" category to provide an alternative response.

Of the six teachers who used information on social connections, all six (100%) indicated that they would use them to create seating charts as well as inform pairing specific students together for group work, four (67%) indicated they would use it for facilitating new social connections as well as which students were most/least desirable to play and work with. Three (50%) indicated they would use this information to assign classroom responsibilities. Of the five remaining teachers who responded that they did not use such information, all of them indicated they would use information on classroom social connections for the various reasons provided. No teachers wrote in an alternative response for the "Other" category.

The survey then asked about teacher awareness of children's regulatory abilities in the same format as the previous set of questions regarding peer connections. All eleven of the teachers indicated that they had a sense of their students' behavioral regulation abilities. All teachers indicated that they get a sense of these abilities from daily observations and conversations with students, nine (82%) indicated that they converse with other adults, 10 (91%) indicated that they use student work to help inform them, three (27%) indicated that they used specific data. Follow-up conversations with these three teachers indicated that the data they used took the form of anecdotal logs (e.g., noting specific student behaviors, as well as the times and days on which they occurred) and call logs (e.g., times they called parents for disciplinary reasons or to inform parents of a student's exemplary behavior).

When asked whether and how they use information on children's self-regulation abilities to influence classroom decisions, six teachers (55%) indicated that they do. Of those six teachers, all six (100%) indicated they use such information for classroom seating arrangements and for group work, five (83%) indicated they use it to facilitate new social connections, four (67%) use it to determine who is most/least desirable to play and work with, and two (33%) use it for assigning classroom responsibilities. No teachers indicated wrote in an alternative response for the "Other" category. Of the five remaining teachers who responded that they did not use information on children's regulatory abilities to inform any classroom decisions, all five indicated that they would use such information for the reasons provided, particularly for creating seating arrangements and forming groups for classroom activities.

The survey asked teachers to provide open-ended responses to the following: *Please describe any practices you use to facilitate children's behavioral regulation (e.g., staying focused on tasks, planning for and carrying out tasks, etc.)* and *Please describe any practices you use to facilitate children's emotional regulation (helping children express emotions in a productive way, keeping outbursts to a minimum, etc.).* Teachers were also given the option to add any additional thoughts on their instructional decision making in the classroom. Table 29 shows the types of responses teachers provided.

Table 5.8. Teacher strategies for facilitating behavioral and emotional regulation.

	Instructional strategies	Management strategies (behavior-focused)	Special Materials	Motivational tools
Behavior Regulation Strategies	• Whole brain teaching • Have student repeat directions • 'Brain breaks' • Partnering students who are likely to keep each other focused • Limit independent work time to 15-20 minutes • Change literacy centers often	• Repeated practice of appropriate behaviors/modeling expectations • Redirect to task • Physically standing/sitting by students who need help following rules	• Fidget toys • Headphones • Velcro under table • Timer • Visual schedule • Behavior chart • Graphic organizers	• Reward system of table points
Emotion Regulation Strategies	• Teach character lessons (role play problem-solving scenarios) • Teaching "I" messages • Changing seating arrangements to minimize conflict	• Create individual plans for students when needed • Model expected behaviors • Encourage students to use words • One-on-one conversations with students • Outside help (e.g., social worker, para, etc.) if needed • Deep breathing strategies	• "Safe place" area of classroom • Weighted stuffed animal/sooth-ing toys • Soft blanket • Posters that provide children with strategies to deal with emotions)	• Motivational songs or chants

Teacher responses varied, but shared a few common themes. For both behavioral and emotional regulation, teacher modeling expected and acceptable behavior was cited as a key strategy. Additionally, there seemed to be four categories underlying both types of regulatory strategies: *Instructional strategies* (e.g., teacher actions that would typically impact all students), *Management strategies* (e.g., teacher actions that would initially be intended for the whole class, but would eventually focus on specific students' behaviors as needed), *Special materials* (e.g., specific objects that teachers could use to help students develop regulatory abilities), and *Motivational tools* (e.g., actions that appeared to lead students to *want* to regulate themselves). Instructional strategies appeared to be more common for behavioral regulation, whereas management strategies were more common for emotion regulation. Teachers provided lists of special materials they used to help facilitate both types of regulation, including items that calmed children down (emotional), as well as provided them with an outlet for energy and blocked out distracting stimuli (behavioral). Motivational tools appeared to serve the purpose of providing students an engaging activity that would increase desire to better regulate themselves. The table points system is intended to reward students for successfully using regulatory strategies, and likely also for co-regulatory strategies, as points are typically awarded based on how well the group meets expectations.

Finally, the survey asked teachers whether they had any additional thoughts to add regarding peer connections and regulatory behavior in the classroom. One teacher commented, "Social connections are usually naturally created and maintained." Another teacher responded, "I like to change things up every quarter. When I found I was retaining two students, I seated them next to one another so that they could build a friendship before next year." Finally, a teacher provided a brief, yet accurate overview of the kindergarten year: "Kindergarten is a very special

time. [Students] are learning to be independent, cooperate with others through play and academics. It is their first year of education. It is a big step and can be very stressful."

Discussion

Chapter 3 had previously established that teachers are relatively accurate when rating children's academic competence and executive function skills (attention, inhibitory control, and working memory). The current study extended this finding by investigating how accurate they were in identifying children's closest peer connections in the classroom. When making decisions on seating charts and group work, teachers were most concerned with (a) ensuring that behavior problems were separated, (b) accommodating special needs and (c) creating gender diversity within groups. Teachers considered potential behavior issues to be the most important factor in determining groups, which confirmed work by Gest and Rodkin (2011) and provided additional information, as their scale did not include items on special needs or gender diversity. Teachers moderately endorsed the need to promote academic homophily or diversity, promoting new friendships, and create racial or ethnic diversity. Finally, promoting existing friendships appeared to be the least important factor teachers considered when making decisions on classroom groups. This last result also mirrored the findings by Gest and Rodkin. From these results, one can infer that teachers placed a practical importance when deciding how to form groups in the classroom. The most important consideration was ensuring that the classroom was well managed, with students likely to disrupt others not seated near one another. Equally as important for teachers was ensuring that they accommodated any specific need a child might have. From the results, one can infer that when forming groups, teachers are far less concerned with ensuring that students they believe to be friends are seated near one another or work together during classroom activities. This is likely due, in part, to a belief that friends will distract one another and lead to

less productive partnerships. This was confirmed by the correlation results. The more a teacher emphasized separating behavior problems in her classroom, the less emphasis she tended to place on reinforcing existing friendships. Additionally, creating racial and ethnic diversity was rated, on average, as the second least important consideration when forming groups. This does not necessarily suggest that teachers do not place importance on diversity in the classroom. The schools included in this study were not particularly diverse with regard to race or ethnicity. As a result, teachers within those schools may place less of an emphasis on creating racial or ethnic diversity because they do not have the opportunity to do so within their classrooms.

Although examining teacher beliefs as a function of the school's socioeconomic status was not a primary aim of this study, results nonetheless showed that teachers from low and high SES schools differed with regard to the importance they placed on seating children with similar skill levels together and seating friends together. Specifically, teachers from the two low SES schools were more likely to emphasize sitting children together who had similar skill levels, as well as sitting friends together. It is unclear as to why this might be the case. It may be a function of each particular school having their own philosophy on grouping students, or an effect of colleagues at each school sharing and adopting similar grouping strategies that work for them. Unfortunately, a sample including two high SES schools and two low SES schools does not allow for generalizations. Future studies may focus on SES differences in teacher beliefs and decision-making with regard to arranging children in the classroom.

Another goal of this study was to compare how seating charts reflected teacher beliefs about peer connections when making grouping decisions. There were no relations between the scale items referring to friendship and how many friends were actually seated together in the classroom, as might be expected. For example, one might anticipate a positive relation between

promoting existing friendships and the number of friends seated together within a classroom. However, across the sample, students in the study were almost equally as likely to be sitting at a table with one of their (teacher-nominated) friends as not. Essentially, teacher beliefs on making grouping decisions may not have been the primary determinant of which students were actually seated together. In fact, teachers were more likely to seat high-regulated children near a friend. Interestingly, individual Head-Toes-Knees-Shoulders score, not teacher-rated self-regulation, was the variable most significantly related to whether teachers sat children together they believed to be friends. Additionally, teachers were somewhat more likely to sit girls near a friend. These results are not surprising, considering that teachers will most likely seat children near a friend if they believe the children are capable of handling such an arrangement. Furthermore, research on the development of self-regulation in early childhood has found that girls are typically more regulated than boys. Thus, teachers' tendency to allow highly regulated children to sit with a friend is reflective of teacher beliefs on separating behavior problems. If teachers allow two friends to sit together in the classroom, they are likely to be high-regulated children, and a good number of those children tend to be girls.

Clearly, teacher decisions on grouping students in the classroom are highly influenced by the need to separate behavior problems, which, according to teachers, implicates close friendships. However, outcomes for these decisions are predicated on whether the teacher is *accurate* in assessing each child's closest friend connections. This necessitates the consideration of the student perspective. Results showed that, overall, teachers correctly identify close friendships a little over half the time, with some being much accurate than others. Interestingly, the most accurate teacher correctly identified 71% of the close peer connections among students included in the study, and the least accurate teacher correctly identified 40% of her student's

close peer connections. Clearly, a margin for error is to be expected. Teacher perceptions of peer networks are based on hours of interaction with and observation of her students, whereas children's perceptions of peer networks may change on a weekly or even daily basis, depending on whether a child has fallen out of favor with another. Nevertheless, there was no teacher variable that appeared to account for the variation in accuracy, including years of experience. For example, the teacher who correctly identified 71% of peer connections had 28 years of total teaching experience, most among all teachers in the study. The teacher who had the second highest accuracy (67%) had 2 years of teaching experience, least among teachers in the study. Thus, student factors were considered to account for disparities between teacher and student perceptions of close friendships. Children were much more likely to consider academic ability when nominating students than teachers. Although teachers tended to nominate more children who showed higher math and reading scores, and who they rated highly in reading competency, math competency, and social skills, students considered these factors, as well as self-regulatory ability, teacher rated inhibitory control, attention, and working memory. Thus, children who were perceived as higher in these areas by their kindergarten peers received more nominations from their classmates. It seems that in nominating friends, students may be nominating kids they would *like* to associate themselves with and possibly emulate, including those peers that are high achieving and highly regulated. Students, in all likelihood, form such perceptions of their peers as a result of teacher actions. For example, if a child sees a teacher praise another student for following directions, they know what type of behavior gets praised or rewarded. Over the course of the school year, students become aware of which students are skilled in reading or math, and tend to follow directions. The teachers, by contrast, likely consider the more holistic reality of which children tend to associate most often (e.g., on the playground, during free time).

Children's associations may not necessarily mirror who they claim are their closest friends. This may account for some disparities between teacher and child nominations of best friends.

Teacher Responses: Qualitative Results

While the quantitative aspect of this study established that, based on student characteristics and the classroom seating charts, teachers do consider peer connections as well as students' regulatory abilities when making grouping decisions, the qualitative component provided a more detailed picture of whether how practitioners thought about these factors. As expected, all teachers in the study use multiple group activities throughout the school day. This is typical of early childhood classrooms for a variety of reasons, including the development of social skills and to provide children with the opportunity to learn from peers. Although it is less common for teachers to organize students into large groups (five to seven children), it is fairly common that children are in groups of three to four. It is most common for teachers to pair children or to have all children together for whole-group instruction.

The majority of teachers indicated that during group activities, the signs that children are working well together commonly focused on individual behaviors characteristic of highly-regulated children, such as taking turns, sitting still, speaking at an appropriate volume, and being on task. During unsuccessful group work, teachers cited behavior typical of children with low levels of regulation, such as fooling around, speaking in loud voices, and disrupting others. While these common responses were expected, it was useful to see what responses teachers gave that addressed the pair or group dynamic, rather than an individual child's behavior. Some teachers indicated that they would like to see children helping each other "using language" (e.g., 'I like your idea', "we could also do this') and feeling comfortable enough with their partner to "take risks when working together". Phrases like "each other" and "working together" indicated

that teachers were considering the transactional nature of the group activity. Conversely, when children were not working well together, the dynamic included "high frustrational levels of the children in the pair", "one person dominating", and "one [child] goofing around, the other is upset that work is not getting done." Again, a few of the teachers considered how both children in an unsuccessful partnership were affected. Clearly, some teachers consider the co-regulatory nature of group activities in deciding whether a group works well.

Regarding co-regulation, all but one teacher in the study responded that they had observed students attempting to regulate one another. The teacher who said she had not observed co-regulating behaviors also indicated that she felt that any attempts by children to regulate their peers were limited to tattling. Among those that responded yes, the use of verbal reminders by students during group work was a common theme, as well as modeling correct behavior. Essentially, the ways in which teachers described students that attempt to regulate their peers evoked the image of students as extensions of the teacher, in that they use strategies to ensure on task behaviors that the teacher has already reinforced. In this way, the teacher's burden of having to ensure that each group is on task is lessened.

Again, a few teachers seemed to envision an ideal partner dynamic: "a student who can be off task when working with a friend does a better job of staying on task with someone else. Students who work well independently are able to help struggling students stay on task." In other words, one must teach students strategies to work independently, and ultimately, they will begin to use co-regulatory strategies to help their peers. However, what types of students will be capable of developing these skills? Teachers identified individual attributes of leaders in the classroom and again, they coincided with characteristics of successful group work. Staying on task, listening to directions, following classroom rules, and other behaviors are desirable traits

among students. Similarly, staying on task by *avoiding* the temptation to go off task is something teachers alluded to in their responses. One response was that children who are leaders "will follow all directions and get others to do the same." Although the survey response did not include more detail regarding *how* a student would get others to follow, one might imagine that the previously mentioned leadership qualities might inspire a child's peers to join them in completing a task. Essentially, being a leader and being capable of successfully co-regulating others appear to be *skills* that students develop, like any other ability. Researchers and teachers alike should begin to break down co-regulation into a series of teachable skills in order to create an ideal classroom dynamic. This will be discussed further in Chapter 6.

Limitations

Although this study was unique in that it compared the teacher perspective on peer networks and children's regulatory abilities to the reality, it nevertheless has several important limitations to consider. First and foremost, there were only 11 classrooms in this study, which limits the generalizability of the results considerably. As with the other studies in this dissertation, including a larger and more diverse sample of both students and teachers is a crucial next step in evolving research on this topic.

A second limitation is that I was not able to acquire seating charts for all the classrooms. Subsequently, the study did not provide as complete a picture as it could have if it had included all seating charts. As mentioned, three teachers had either changed their seating charts within a week before the study began, or had instituted a more flexible seating chart for the remainder of the school year. Along with obtaining seating charts from all classrooms, it would be useful to collect this information at different time points throughout the year along with data on peer connections and children's abilities. A longitudinal design would be ideal to help researchers and

teachers detect patterns in students' individual development as well as the evolution of peer connections.

A third limitation is that surveys were used to gather teacher perspectives, rather than interviews (or a combination of both). Scheduling conflicts prevented several teachers from being able to free up time for an interview. Additionally, a few teachers expressed a hesitance to be interviewed, for fear of being "put on the spot" and "not knowing what to say" in the moment. While follow up emails to teachers did provide a few additional insights, it would be more informative to have teachers fill out the survey and then conduct a cognitive interview to ask them questions about their thoughts in completing the survey, once they have had a chance to write their thoughts down in a systematic and organized fashion.

Implications

This study has several implications for researchers and educators. In addition to the previously described ways in which systematic data on peer networks in the classroom could inform teachers and improve their instructional decision-making, this study also indicates the need for collaboration between teachers and researchers. A major impetus for this study is the off-hand comment made by a teacher I encountered previously that she does not sit friends together in her classroom. This spurred my interest in how teachers actually make such decisions, and whether this was a widely held belief by teachers of young children, and whether this belief indirectly has an impact on the kindergarteners' development of various skills. Thus, this study takes a practical concern of teachers (e.g., how to arrange students in the classroom) and provides a context for comparison between the classroom realities and teacher perceptions.

As expected, all teachers in the study felt they had some sense of both the peer connections in their classroom and the regulatory abilities of their students. Indeed, it is difficult

to imagine a teacher professing a lack of awareness of these classroom dynamics to a researcher, particularly near the end of the school year. However, most teachers do not collect formal data (aside from anecdotal notes) on these topics, despite the fact that, overall, they felt it would be beneficial for them to do so. As the data showed, teachers were correct about children's peer connections slightly over half the time, despite teachers' collective belief that they have a sense of these connections. Gathering formal data from students may provide new insights on classroom dynamics. Sociograms, described in Chapter 2, are a simple yet effective way for teachers to improve their understanding of peer ecologies, as well as how they change over the course of the school year. Asking each child in the class who their best friends are takes relatively little time, but can help influence a variety of instructional decisions, as evidenced by teacher responses. Creating seating charts, partnerships for group work, and facilitating new connections among students who have few are just some of the ways in which teachers might use data on peer connections.

In addition to informing a variety of classroom decisions, teachers could use systematic information to inform their strategies for facilitating behavior and emotional regulation. Teachers provided a variety of methods they use to facilitate this ability within students. Additionally, teachers may start to consider how to facilitate co-regulation among students during group activities. Teachers likely already do this to some degree by ensuring students develop necessary social skills, such as taking turns, sharing, and generally being respectful of others. However, in describing the attributes and skills of leaders in their class, they also described the types of desirable co-regulating behaviors they wish to see in their students. Perhaps additional information on peer networks and children's regulatory abilities could enhance teacher strategies for facilitating co-regulating behaviors. This highlights the need for researchers and teachers to

use their respective areas of expertise to help inform one another in order to 1) use actual classroom phenomena and teacher input to help guide research designs that focus on using ecologically valid measures, and 2) disseminating research to educators so that they feel it is meaningful and accessible.

In addition to the need for researchers to make their studies meaningful to practitioners, they must also ensure that the dissemination of research does not take agency away from teachers. For example, after I had collected data in her classroom, one teacher remarked to me that she had started to think about peer connections more in her classroom. As a result, during snack time, she had children choose their own seats and write their names down on a sheet of paper to indicate which classmates were at each table. This was a simple yet effective way for a teacher to quickly document peer connections, as they existed in the classroom *that day*, rather than rely on the general perceptions of friendships in the classroom she had acquired over the course of the year. Informally collecting data this way on a fairly regular basis might inform a teacher of patterns and changes in her class. An important aspect of this teacher's efforts was that she took it upon herself to collect this information, rather than having it prescribed to her by a researcher who has spent a limited amount of time in her class. This is a crucial aspect of collaboration between researchers and teachers that must continue to be strengthened, and the current study represents another step towards accomplishing this goal.

Future Directions

In addition to the aforementioned ongoing collaboration between researchers and educators, there are several new directions regarding the future of this research. This study presents promising empirical findings about factors that influence teachers' instructional decisions in the classroom, particularly with regard to seating charts. One key issue for future

research is clarifying teachers' thinking on the development of children's peer connections, and regulatory abilities. As described above, accompanying a survey like the one used in this study with a more detailed follow-up conversation with each teacher (e.g., cognitive interviews) would likely provide new insights into the bidirectional relationship between teacher actions and student behaviors. In addition to seating charts, collecting data on other physical arrangements in the classroom (e.g., carpet spots, center groups, etc.) would provide a more detailed look at how children's proximity to one another may influence the development of peer relationships, as well as a better sense of teacher choices throughout the school day. Collecting such data at various points throughout the school year would allow for researchers to learn about the evolution of peer relationships in early childhood classrooms.

The literature on teacher influences on peer ecologies is not new (e.g., Gronlund, 1959; Lewin, 1943); however, the development of conceptual models that examine the processes involved are more recent (e.g., Farmer, 2006; Gest & Rodkin, 2011). Future research must continue to build on more recent studies that compare teacher beliefs with existing patterns of social dynamics, including observations of the classroom. A challenge for researchers will be doing so in a way that includes teachers within the research design process and provides useful, practical information for teachers to consider and decide to use as they see fit. The general discussion in Chapter 6 will focus on future work with these considerations in mind.

Appendix H
Teacher Survey

Thank you for participating in this study!

This is a questionnaire about:

1) Student social connections in the classroom: who students typically associate with most in the classroom, who they prefer to work with in class, who they prefer to play with during free time or on the playground, etc.

2) Student self-regulation abilities in the classroom: Cognitive regulation refers to how well children can remember instructions, stay focused on tasks, avoid getting distracted, monitor their progress, etc. Emotional regulation refers to how well children can keep emotions (both positive and negative) in check, avoid emotional outbursts, etc.)

We are interested in whether/how teachers use data in the classroom on these topics to inform classroom decisions. Please be as detailed as possible when completing the questionnaire.

Demographic information

Name: _____

School Name: _____

City, State: _____

Current Grade: _____

Total years of teaching experience: _____

Years of teaching experience in current grade: _____

Number of Students in current classroom: _____

Teacher education program (check one):

___ Traditional (e.g., undergraduate program) ___ Alternative certification (e.g., Teach For America)

___ Other (please specify): _____

Highest degree earned: _____

Please consider how you make decisions in your classroom. For each of the following statements, please indicate the level to which you agree that

Do you use a ***seating chart*** in your classroom? Yes No

If you answered yes, how are the seats arranged in your classroom?

____ rows
____ tables (number of seats per table = _____)
____ groups of desks (number of desks per group = _____)
____ other (please specify): _____

1) How do you make decisions on how children are physically arranged in the class (e.g., seating charts, carpet spots, etc.)?

I make decisions on how children are physically arranged in the classroom based on:

	Strongly Disagree				*Strongly Agree*
Students' academic level or ability:	1	2	3	4	5
Gender:	1	2	3	4	5
Children's sociability (e.g., talkativeness):	1	2	3	4	5
Children's behavior (e.g.):	1	2	3	4	5
Children's peer connections (e.g.):	1	2	3	4	5
Learning "style":	1	2	3	4	5
Physical needs (visual/hearing impairment)	1	2	3	4	5
Special needs (other impairment)	1	2	3	4	5

Other (please specify): _____

*****Now please think of a typical day in your classroom*****

2) Do you have students engage in activities in which they are supposed to be working together (e.g., pairs or groups)?

Yes No (circle one)

On a typical school day, how often do children do children work:

In pairs?	1-2 times	3-4 times	5+ times

If possible, please give an example of such an activity: _____

In small groups (3-4 students) 1-2 times 3-4 times 5+ times

Please give an example of such an activity: _____

In large groups (5-7 students) 1-2 times 3-4 times 5+ times

Please give an example of such an activity: _____

Whole class: 1-2 times 3-4 times 5+ times

Please give an example of such an activity: _____

*****If applicable, think of the partner or group work that typically occurs in your classroom.*****

3) What (student actions) do you notice are happening when students work well together? Please list/describe at least 2 specific behaviors.

4) What things do you notice are happening when students do not work well together? (e.g., things the students are doing/not doing; please list/describe at least two specific behaviors)

5) Do you observe students exhibiting behaviors that help regulate their peers?

Yes No (circle one)

If so, please list/describe at least two of these behaviors:

6) Do you have any particular student(s) that you believe to be "leaders" or more capable of making sure a group is on-task? If so, think of one such child. What characteristics does this child have that tell you s/he is a "leader"?

7) Do you have a sense of the social connections in your classroom (e.g., which students prefer to play with/work with each other)?

Yes No (circle one)

How do you come to know about these social connections? (check all that apply)

_____ daily observations
_____ conversations with students
_____ conversations with other adults (e.g., parents or other educators in the school)
_____ student work (e.g., writing or drawing)
_____ specific data (e.g., asking students directly about preferences and keeping track of this information)
_____ other (please specify): _____

8) If you have data on social connections in the classroom, do you use it to inform classroom decisions?

Yes No Not Applicable (circle one)

If so, how? (please check all that apply)

_____ classroom seating arrangements
_____ group work (e.g., pairing certain students together)
_____ facilitating new social connections among students
_____ determining which students are viewed as most/least desirable to play with
_____ determining which students are viewed as most/least desirable to work with
_____ assigning classroom responsibilities (e.g., job chart)
_____ other (please explain) _____

If not, would you use data like these?

Yes No Maybe (circle one)

If you would use data like these, how might you do so? (please check all that apply)

____ classroom seating arrangements
____ group work (e.g., pairing certain students together)
____ facilitating new social connections among students
____ determining which students are viewed as most/least desirable to play with
____ determining which students are viewed as most/least desirable to work with
____ assigning classroom responsibilities (e.g., job chart)
____ other (please explain) _____

9) Do you have a sense of each child's behavioral and emotion regulation abilities in your classroom (e.g., how well children are able to pay attention to and remember instructions, focus on a task until completion without getting distracted, keep emotional outbursts to a minimum, etc.)?

Yes No (circle one)

How do you come to know about these self-regulation abilities? (check all that apply)

____ daily observations
____ conversations with students
____ conversations with other adults (e.g., parents or other educators in the school)
____ student work (e.g., writing or drawing)
____ specific data (e.g., asking students directly about preferences and keeping track of this information)
____ other (please specify): _____

10) If you have data on social connections in the classroom, do you use it to inform classroom decisions?

Yes No Not Applicable (circle one)

If so, how? (please check all that apply)

____ classroom seating arrangements
____ group work (e.g., pairing certain students together)
____ facilitating new social connections among students
____ determining which students are viewed as most/least desirable to play with
____ determining which students are viewed as most/least desirable to work with
____ assigning classroom responsibilities (e.g., job chart)
____ other (please explain) _____

If not, would you use data like these?

Yes No Maybe (circle one)

If you would use data like these, how might you do so? (please check all that apply)

____ classroom seating arrangements
____ group work (e.g., pairing certain students together)

____ facilitating new social connections among students
____ determining which students are viewed as most/least desirable to play with
____ determining which students are viewed as most/least desirable to work with
____ assigning classroom responsibilities (e.g., job chart)
____ other (please explain) _____

11) Please describe any practices you use to facilitate children's cognitive regulation (e.g., staying focused on tasks, planning for and carrying out tasks, etc.)

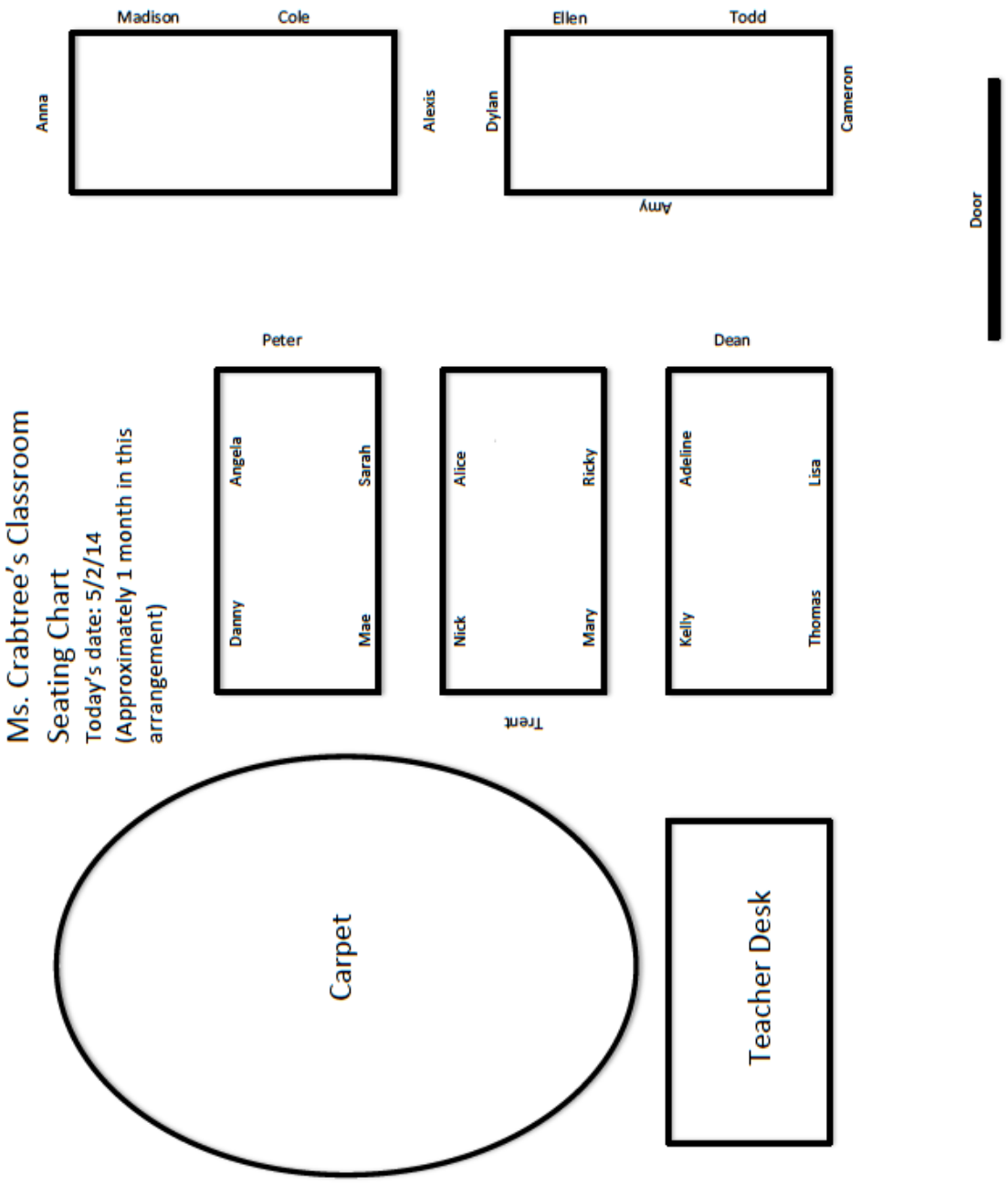
12) Please describe any practices you use to facilitate children's emotional regulation (helping children express emotions in a productive way, keeping outbursts to a minimum, etc.)

Please add any additional comments you may have about student regulation or social connections in the classroom:

Thank you for your participation!

Appendix I

Sample Classroom Seating Chart



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CHAPTER SIX

General Discussion

The three studies comprising this dissertation represent an attempt to integrate research on children's individual regulatory abilities, their classroom peer connections, and teachers' instructional decision-making. Study 1 adapted a commonly used measure of children's self-regulation/executive function to examine how individual children's regulation skills differ from an individual to a paired setting. Study 2 further investigated the ways in which peers influence one another, by placing children in a paired problem-solving context. Both Studies 1 and 2 used a novel methodology by systematically pairing students on two factors 1) their peer status (whether they were considered "friends" by the teacher) and 2) their individual regulatory ability (higher or lower, relative to their class). Additionally, Study 2 examined specific behaviors that occurred between students, referred to in this work as co-regulatory behaviors. Study 3 compared the teachers' perspectives to the student phenomena from the first two studies in order to better understand practitioners' awareness of these factors and how they influence pedagogical choices.

Conclusions

Each study of this dissertation revealed several findings related to both primary and secondary research questions. In addition to a more detailed discussion to follow, the main findings of each study will be presented here:

- Study 1 found that the difference in children's performance on a self-regulation assessment from an individual to a paired setting largely depended on the regulatory ability of their partner, but not whether the partners were friends.
    - A peer status by pair type interaction effect was found for boys, such that boys in Low/Low, friend pairs scored significantly lower than non-friend pairs on HTKS.
    - Additionally, Study 1 determined that students in Low/High pairs looked to their partner for help significantly more than students in High/Low pairs.
    - Paired HTKS score did not predict math or reading achievement above and beyond individual HTKS score.
- Study 2 found that pairs' overall success on the problem-solving task was influenced by whether the pairs were (teacher-nominated) friends.
    - Additionally, there was a main effect of gender and a peer status by pair type interaction effect on one co-regulatory behavior—preventative directing language. Specifically, girls and friends within High/High pairs exhibited more of this type of co-regulatory behavior. Conversely, friends in Low/Low pairs showed less of this behavior than non-friends.
    - There was a peer status by pair type interaction effect on physical involvement in the task. Students in Low/High, friend pairs were more physically involved, whereas students in High/Low, friend pairs were less physically involved.
    - Predictors of each type of co-regulatory behavior varied. Notably, reading score and paired HTKS score positively predicted only verbal facilitative language.

- Study 3 revealed teachers consider ‘separating behavior problems’ to be the most important factor, and ‘reinforcing existing friendships’ to be the least important factor when grouping students in the classroom.
    - Regarding whether teacher and student nominations were a match, teachers were accurate slightly over half the time with regard to their nominations.
    - All teachers claimed to be aware of their students’ regulatory abilities and peer connections within the classroom.

The collective finding that children’s behavior and performance on different tasks is dependent on the task itself is hardly surprising; however, this result has various implications for both researchers and educators who are interested in examining student peer dynamics and their impact on child development.

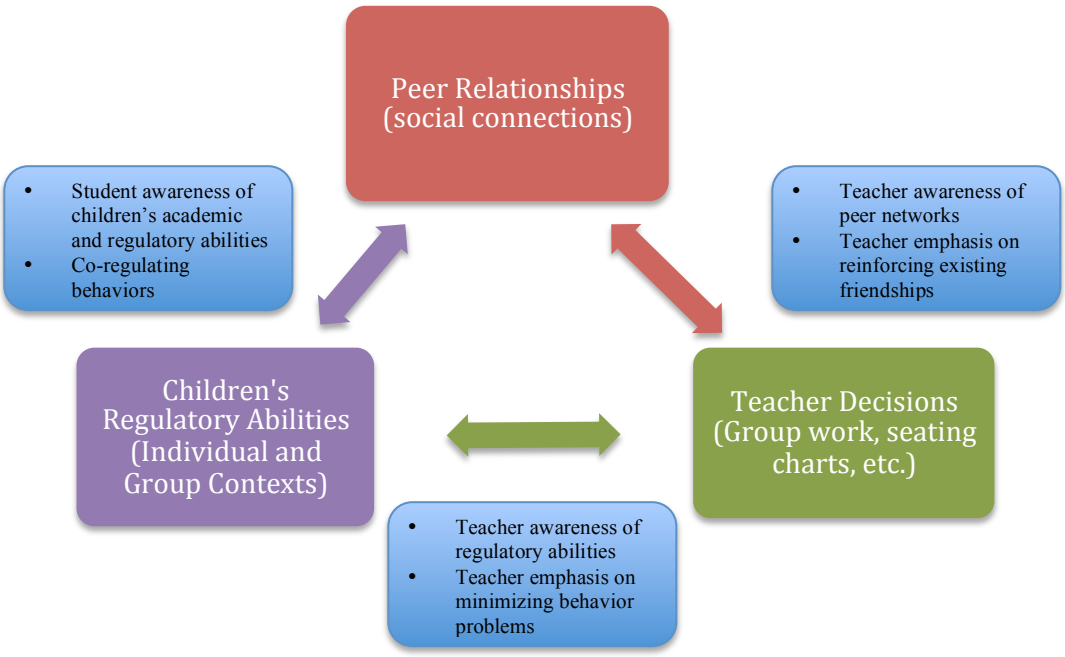

Figure 6.1. Modified model of proposed relations between peer relationships, co-regulation, and teacher decisions.

Figure 6.1 shows a modified version of the proposed model previously presented in Chapter 2. The additional boxes indicate the specific factors of interest investigated by the current set of studies, shown to have an impact on each bidirectional relationship. It is clear that these three studies have further illuminated the connections between children's regulatory abilities, peer connections, and teacher decision making in the classroom. Teachers were found to be highly aware of each child's individual regulatory abilities and, to a lesser degree, aware of the peer connections in the classroom. The latter finding lends support to previous studies demonstrating that teachers are not particularly accurate when it comes to identifying student friendships in the classroom (Gest, 2006: Pearl et al., 2007). Nonetheless, Study 3 suggested that teachers consider both of these factors when deciding how to arrange students in the classroom. For example, if teachers perceived two students as good friends, they tended to place those students at different tables, unless the students were highly regulated. This was done in an effort to minimize behavior problems, which teachers expressed as their greatest concern when creating seating charts and groups. While it is clear that student behaviors influence teacher decisions, it is less clear how teacher decisions with regard to student arrangements in the classroom influence children's peer relationships and regulatory abilities. Because of the cross-sectional nature of the research design, drawing conclusions about how a child's physical placement in the classroom impacts them over the course of the school year is not possible. Thus, further research examining the relations within the proposed model would require longitudinal data.

Also less clear are the ways in which prolonged friendships relate to students' regulatory abilities and vice versa, although these studies provide some new insights for consideration. Study 3 showed that students are likely to consider a variety of factors when nominating another

student as a "best friend", including their academic, social, and regulatory abilities in the classroom. Thus, regulatory abilities appear to influence whom students *claim* are their best friends, but this does not necessarily mean those students are friends, according to the nominated student, or the teacher. Considering the reverse direction—determining how friendships impact students' regulatory ability—it appeared that, for the most part, being close friends with another student did not impact how well they performed or how often they looked to their partner for help in the paired HTKS task. Instead, performance depended on the regulatory ability of one's partner. In the case of low-regulated boys, being paired with another low-regulated boy that was also a friend had a particularly negative effect on paired HTKS performance, as might be expected. Furthermore, high-regulated children paired with a low-regulated partner who was also their friend looked to that friend more for help during the paired HTKS task; however, high-regulated children did not tend look to their low-regulated partner for help if the partners were not close friends. As discussed in Chapter 3, this may be due to children's awareness of the general abilities of the other students in the classroom. A longitudinal study that included measures of regulatory skills and peer connections at the start of the school year would capture student behaviors when the students were not yet familiar with each other. It would be particularly interesting to gauge more nuanced student perceptions of their classmates over an extended period of time, such as which of their peers they would prefer to play with as opposed to do an academic task with, and whether their nominations differed depending on the question they were asked.

While Study 1 showed the importance of students' individual regulation as an influencing factor for paired performance on a regulation assessment, the paired tangram task in Study 2 revealed the importance of peer connections on a collaborative, problem-solving task. The most

compelling outcome from this study was that, contrary to my hypothesis, friend pairs exhibited lower performance on the puzzle task than non-friend pairs. Furthermore, friend pairs were more likely to use preventative directing language (e.g., telling a partner "stop", "wait," or "don't"), to have more off-task utterances (e.g., friendly banter), to be less physically involved in the task, as well as to comment on the difficulty of the task itself. The latter finding may be related to the fact that children in friend pairs appeared to respond that they would rather complete an "easier" (previously completed) puzzle than continue working on the puzzle they had not yet finished, signifying a performance goal orientation (Dweck, 2002). Additionally, work by Newcomb and Brady (1982) indicated that the demands of an experimental task must create the need for coordination and mutual effort if the benefits of friendship are to be apparent in task performance. While the paired tangram task was designed to create a need for coordination and collaboration, it may be that the children's age and nascent collaboration skills impact how friendship dynamics affect the group success as a whole.

Conversely, individual regulatory behavior did not appear to have an impact on group success on the task, as there were no group differences in tangram puzzle score across the different regulatory pair types. However, a low-regulated student paired with a low-regulated partner tended to use less preventative directing language with a friend, whereas high-regulated children paired with a high-regulated friend used more preventative language during the task. Finally, the study showed that low-regulated children paired with a high-regulated friend tended to use more preventative directing language. Thus, it appears that the preventative language used by high-regulated children may influence low-regulated children to use similar language during a problem-solving task. Essentially, high-regulated children seem to use more facilitating and preventative language, possibly due to having a higher vocabulary, higher confidence levels in

the task, or both. Low-regulated children may not feel as confident in the task itself, and thus defer to a more confident, vocal partner. However, in some cases, low-regulated children, particularly girls, may adopt some co-regulating language when they feel comfortable with a partner, although the increase in co-regulatory speech may not always be beneficial to the group.

The results of Study 3 suggest that teachers consider several costs and benefits when deciding how to pair students. On one hand, teachers often would like lower-achieving students to increase their vocabulary and become more confident academically and socially. On the other hand, teachers would likely not encourage low-regulated children picking up the types of habits, such as using more preventative language, from a high-regulated partner that adversely impact the group's progress on a task. Although this study provides new information on how systematically paired children may influence each other, both positively and negatively, the fact remains that this influence is largely task-dependent. The finding that friendship patterns were found to influence success on the tangram task relates to work by Newcomb and Bagwell (1995), which suggested that specific task types may be more conducive for friends experiencing success. Specifically, tasks that require spontaneity and creativity may lead to more success among friends, as opposed to tasks that require strict adherence to the task structure. The tangram puzzle task was intended to create a need for collaboration between partners; however, because the task did not allow for creativity between partners, it may have actually *decreased* the likelihood of success between friends on the task.

As mentioned previously, the work of Steiner (1972) within the social psychology literature characterizes different tasks, as well as their potential to impact group outcomes. According to this view, the tangram task used in this study would be considered *unitary*, due to the indivisible nature of the task. Additionally, the task was an *optimizing task*, with success

determined to how closely pairs came to solving each puzzle. Finally, the task was *disjunctive* in nature, meaning group members had to arrive at one consensus response for each puzzle. Creating, or adding, a task in future work may involve tasks that are *divisible* in nature, in which the larger task affords children the opportunity to each have a specific role. A task for future work may also be *additive*, in that it allows for each group member's individual contribution to add to the greater group output.

In addition to the type of task used, the length of the task is likely a major factor influencing the outcome. Chapter 4 discusses the eight-minute trial time as a limitation, due to the fact that a longer task would allow a greater opportunity for students to adjust to both the task and their specific partner. Increasing the length of the task may also have a negative effect on pairs of students, in that specific counter-productive behaviors (e.g., preventative directing language) could become more prevalent for certain pair types. Future work would do well to collaborate with teachers on the appropriate length of time for a group activity, as well as suggestions for various activity types that mirror the everyday group work that happens in kindergarten. The results suggest that teachers should consider making decisions that maximize benefits for students that include a variety of activities for several subjects over the course of a school year. Likewise, future research on this topic may include various types of tasks for partners to collaborate on, particularly those that vary with regard to their rigidity and potential for creative solutions.

Contributions

As discussed in the preceding chapters, the research design for this series of interrelated studies focused on using a novel approach to studying young children's interactions. While research had examined interactions between students in upper elementary and middle school

grades during collaborative tasks have been studied (e.g., Azmitia & Montgomery, 1993; Davis & Neitzel, 2010), less work has been done to examine children's interactions as they enter formal schooling. A study by Neitzel (2009) examined relations between the socialization features of kindergarteners' home environments to their academic behaviors in collaborative classroom activities. However, in addition to focusing on home environment factors, this study used observations of children in the classroom as opposed to systematically creating pairs, and did not include a teacher perspective of students' regulatory abilities and peer connections. Thus, the current work addresses a need to build a rigorous empirical literature on the complex interplay between young children during group work in the classroom, as well as the bidirectional relationship between children's behaviors and teachers' decisions.

As discussed in Chapter 2, the definitions of co-regulation, co-regulated learning, and shared regulation are intertwined and complex (e.g., Hadwin, Järvelä, & Miller, 2011). While co-regulation focuses on dynamic processes between individuals, shared regulation involves a co-construction and synthesis of strategies by the group members. These definitions are more applicable when discussing complex group tasks, often starting in the later elementary years. The current work adapts the term co-regulation to define the types of behaviors children are starting to enact, both verbally and physically, to influence another child during a problem-solving task. Additionally, co-regulating behaviors do not necessarily need to be overt (e.g., telling another child what to do), but may also be covert in nature. Study 1 detailed the ways in which children were not actively co-regulating their partners during the paired HTKS assessment, but impacted their partners' responses nonetheless. Thus, children acting as a model of the types of expected classroom behaviors for their peers can be considered a form of indirect, or passive co-regulation.

Although appropriate for the purposes of these three studies, the concept co-regulation is much more complex than the currently adapted definition would make it seem. Thus, an important contribution of this dissertation is highlighting the need to refine the term *co-regulation*, or to modify the definition to include the possibility that co-regulatory behavior may not always be adaptive or act as a support to others, particularly in the early grades when children are only beginning to learn skills on how to work cooperatively with others in the classroom. Study 2 demonstrated that certain behaviors deemed "preventative" co-regulatory behaviors actually appeared to be somewhat detrimental to success on the group task. Consequently, it may be more useful to discuss previously termed "co-regulation behaviors" as broader, bi-directional influences between individuals that is not always supportive in nature. By doing so, researchers can begin to appropriately and flexibly conceptualize these phenomena across the span of childhood into adolescence and beyond, creating a fuller spectrum of the ways, both positively and negatively, that these types of behaviors may bi-directionally impact individuals' cognitive and socioemotional development.

The concept of co-regulation evokes sociocultural theory, specifically the work of Vygotsky and the ways in which children develop both cognitively and socioemotionally. This pioneering work by Vygotsky and his contemporaries has influenced pedagogy in countless ways for several decades; however, it is important to continue improving research methodologies as well as relationships between researchers and practitioners. While Figure 6.2 depicts the teacher's role as the stairway to a child achieving their goal, researchers too must become the stairway to teachers reaching their collective goal of improving pedagogy. As such, teachers cannot view research as a cumbersome series of prescribed "fixes" to their classroom, but rather an attempt by researchers to truly understand the complex phenomena happening in the

classroom and provide teachers with a comprehensive picture of new ways to think about improving children's outcomes.

Figure 6.2. Visual representation of teacher's role within zone of proximal development.

Differences in Regulatory Abilities Among Kindergarteners: Implications for Teachers

As evidenced by Study 3, teachers claimed to be very aware of each child's regulatory abilities, as one would expect (and hope) of an educator near the end of the school year. Indeed, the results showed that teacher ratings of children's academic, social, and regulatory skills were relatively accurate. However, none of the teachers collected specific information on children's regulatory abilities beyond qualitative data in the form of anecdotal notes. These notes are often encouraged by administrators as a way to keep records on student behaviors and actions, in the event that a teacher needs to show evidence that a specific incident or pattern of behaviors has occurred in the classroom. Consequently, teachers in this study did not have quantifiable data on children's regulatory abilities that could inform them of specific skills they may decide to teach in the classroom. While teachers of young children frequently model and reinforce expected behaviors that require self-regulation skills (e.g., how to take turns, how to walk from one's seat

to the carpet, etc.), they are far less likely to formally assess individual students on their ability to inhibit certain actions, focus attention, or remember multiple pieces of information. Using established, validated, and developmentally appropriate self-regulation measures such as the Head-Toes-Knees-Shoulders task at various points throughout the year could provide teacher the same type of useful, diagnostic information about a child that they might receive from a reading or math assessment. However, teachers already carry heavy burdens, and additional child assessments may feel daunting to a kindergarten teacher who is expected to ensure that her students are on grade level in a variety of subjects, at the same time they are facilitating children's adjustment to the formal schooling environment. Ideally, researchers could, in some way, reduce this burden by assessing children's regulatory skills with minimum disruption to the teachers' schedule. In this way, researchers can help create and improve new, ecologically valid measures to capture realistic classroom phenomena while providing teachers with useable information about the students in the classroom.

In addition to self-reporting being very aware of children's regulatory abilities, the sample of teachers indicated that the highest priority they had when creating a seating chart or grouping children for classroom activities was separating behavior problems, which supported the findings from previous work by Gest and Rodkin (2011). This teacher consideration, which is meant to ensure that learning is maximized throughout the day and student conflicts minimized, implicates student self-regulation skills. Subsequently, providing teachers with additional, quantifiable data on their students' regulatory abilities may lead to more systematic ways of arranging students in the classroom. The desired end result, in addition to improving the learning environment, would be to have specific students directly and indirectly helping one another develop in a variety of ways, thereby reducing the teacher's responsibility to be constantly

monitoring students all on her own. As Study 1 indicated, kindergarteners are well aware of which of their peers follows the rules and receives positive reinforcement from the teacher. Study 3 suggested that students will nominate their "best friends" in the classroom with this knowledge in mind, likely due to children wanting to associate with those who are skilled, both academically and socially. As a result, teachers may consider collecting information on an additional dimension of the classroom—peer networks. Teachers involved in this study were provided with the list of their students' peer nominations next to a list of their own nominations to see how accurate they were. While this feedback came at the conclusion of the school year with no chance to use this information, teachers nonetheless responded positively to this feedback. Perhaps providing teachers with such information earlier in the year would provide them with insights into the social dynamics of their classroom that they otherwise would not have had.

Do Friends Help or Hinder Performance?

One of the most substantial results of Study 2 was that friend pairs were, overall, less successful in completing the tangram puzzle task than were non-friend pairs. Additionally, friends were less likely to use facilitating directing language (e.g., suggesting where their partner could place a puzzle piece) and more likely to use preventative directing language (e.g., telling their partner to stop or wait before completing an action). This is not to suggest that facilitating directing language always led to positive results. In fact, Study 2 indicated that this type of verbal co-regulating behavior predicted less success for pairs on the task. Thus, it may be that friends are more likely to interact verbally, and also may be more comfortable in using either facilitating or preventative language. However, too much facilitating language may end up hindering progress toward the group goal, while preventative language from a partner leads

students to become disengaged from a task, as they are not allowed to have a defined role within the partnership. Conversely, non-friends who use less language may also focus more on simply manipulating the pieces. In other words, instead of talking about every action, non-friends would simply carry out the action and decide whether they were any closer to solving the puzzle by observing the actions of their partner. As mentioned in Study 2, one pair of non-friends barely spoke to one another, but finished several puzzles during the eight minute trial. They worked deftly and efficiently, and interacted very little in the process.

Overall, the results suggest that at this age, many children may not yet be particularly skilled in successfully utilizing co-regulating strategies in a group context. This would necessitate teachers to help students learn co-regulatory skills in order to begin learning how to effectively work together. The majority of teachers indicated in the surveys that they observed behaviors that could be categorized as "co-regulating behaviors", including children reminding others of the task directions, modeling correct task-related behaviors for their partner, and using non-verbal cues to keep partners on task. It could be the case that teachers must be provided with new suggestions for focusing more on teaching co-regulation as a skill in and of itself, after more basic social skills (e.g., learning to share and take turns) are developed earlier in the year. The following section discusses a few of these suggestions.

Co-regulation as a Skill: The New Tom Sawyer Effect?

The well-known example of Tom Sawyer convincing his peers that whitewashing a fence was enjoyable and thus, relieving himself of a tedious chore is typically referenced when discussing the power of intrinsic motivation. However, this scenario paints Mark Twain's classic literary character as a clever trickster, skilled in the art of manipulation. Instead, we might look at Tom Sawyer from a different perspective, as a skilled co-regulator of his peers. Indeed, Tom

was able to influence his peers to, comically, pay him for the privilege of doing work. However, the leadership qualities Tom exhibited, namely, getting a group of people to do something they are typically not motivated to do, mirrors the qualities that teachers hope children acquire over the course of the school year. When asked what leadership qualities she saw in her students, one teacher responded that a leader in her classroom "will follow all directions and get others to do the same." Although the teacher did not elaborate on exactly *how* a student was expected to get others to follow directions, perhaps this quality can be viewed as a set of skills that teachers can impart to young children. For example, teachers may model specific types of facilitating language for children to use when working with each other during a collaborative task. Although teachers likely already do this to varying degrees, providing children with an expanded vocabulary to use in a social context would likely encourage children's involvement. For example, one child telling her more passive, less physically involved partner to "put that piece there" could give a less confident student the chance to contribute and take on a greater role within the partnership, while also helping to keep that student on task. Conversely, teachers could listen and watch more closely for verbal and physical preventative co-regulating behaviors, and try to curb such behaviors. Ensuring that one child does not dominate the task and take away opportunities for learning from another child is a key issue for teachers who implement group activities in their classrooms.

It is probably a safe assumption that teachers of young children do not typically endorse teaching manipulation tactics to their students, in the image of Tom Sawyer. However, in the United States, it is a cultural expectation that children learn to get along and work with others, and to learn to appropriately handle conflicts. Thus, researchers must continue to provide information to teachers that will afford new opportunities for modeling behaviors to meet these

societal expectations. Teaching children developmentally appropriate verbal and physical co-regulatory skills is a first step towards maximizing the benefits of group work in the classroom. In a similar vein, learning to be a *recipient* of co-regulatory behavior may be nearly as important for teachers to model for students. While counterintuitive, it is virtually impossible for all students in a group to be leading at once. Subsequently, having students learn to adapt to the co-regulation attempts of others will be another area for teachers to consider. Therefore, both researchers and educators must learn to take the essence of Tom Sawyer's example and reinforce positive co-regulating skills, as well as how to respond to them. Although children may not be as successful in using these skills as they enter formal schooling, the consistent reinforcement of these skills over the course of a child's school career can have a far-reaching impact on their development. With the help of educators, future research on this topic will begin to illuminate the exciting beginning of this life-long process.

Outlook for Future Work

The preceding sections of this chapter have outlined several suggestions for both researchers and educators in order to build on the existing understanding we have about children's behavior and its impact within the classroom environment. It is the responsibility of researchers in the field of education to conduct research and disseminate information in a manner that does not reduce a teacher's agency, but rather, ensures that they have a collaborative role within the process. While the overarching goal of this work is to learn more about children's dynamic cognitive and social processes in order to ultimately improve pedagogy and enhance student learning, an equally important aim is for educators to know they are valued within the research process. Additionally, it is crucial that researchers maintain an ongoing dialogue with educators about this process, so that inevitable disagreements can be addressed appropriately.

Because each person has their own unique set of beliefs based on their experiences, it is naïve to suggest that this research will lead to a collective conceptualization of classroom processes. For example, research has contended that evidence for the concept of "learning styles" in education is not as convincing as previously believed (e.g., Willingham, 2010); however, many teachers still subscribe to the belief that specific students in the class are "visual", "auditory", or "kinesthetic" learners. Thus, although some educators may endorse the results of this dissertation, others may find that it conflicts in some way with their professional experiences and remain skeptical, or indifferent. It is not a researcher's responsibility to force teachers to believe the results and take immediate, data-driven action, but rather, present as complete a narrative as possible to provide teachers with the opportunity and, if desired, potential suggestions to decide how best to use this information. An aforementioned future direction for this study would be to determine whether teachers would be *willing* to use particular types of student data in their pedagogical decision-making process and if so, what form might these data take? Study 3 suggested that teachers would be receptive to such efforts; however, a third grade teacher I informally interviewed before the outset of this dissertation work took place provided her perspective on how data would prove most useful:

> "I don't have any data on social connections other than beginning of the year self-evaluations, teacher evaluations, and anecdotal notes. I do think it would be beneficial to have a research-driven way of evaluating the social connections of students. However, the only way it would be beneficial is if it were a system in which teacher input was also considered - it would be annoying to have yet another system of evaluation that would disenfranchise teachers."

The above quotation effectively summarizes the feelings of a teacher who endorses the concept of data-driven instruction, yet has experienced a loss of agency at some point during the process of collecting or utilizing data for her own classroom. The set of studies encompassed

within this dissertation is an initial step toward providing new methodologies and insights for both researchers and educators to consider. Although the data in this study cannot be generalized to a larger population of kindergarten students and teachers, it is a promising effort toward promoting a sense of inclusion for teachers within the field of educational psychology and ultimately, having a positive impact on the development of young children.

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