PROMOTING SELF- AND COREGULATION THROUGH SMALL GROUP PROBLEM-SOLVING OF AUTHENTIC TASKS IN A LOW SES URBAN ENVIRONMENT

BY

NICOLE C. DIDONATO

A Dissertation submitted to the

Graduate School-New Brunswick

Rutgers, The State University of New Jersey

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Graduate Program in Education

written under the direction of

Dr. Angela M. O'Donnell

and approved by

____

____

____

____

New Brunswick, New Jersey

May 2009

ABSTRACT OF THE DISSERTATION

Promoting Self- and Coregulation through Small Group Problem-Solving of Authentic Tasks in a low SES Urban Environment

BY NICOLE C. DIDONATO

Dissertation Director:

Dr. Angela M. O'Donnell

Over the last twenty years social cognitive models of self-regulated learning (SRL) focused primarily on understanding the processes learners use to self-regulate and the subsequent benefits SRL has on learning and performance. More recently, sociocultural models have begun to argue that SRL is fostered, developed, and maintained (1) within social contexts and (2) as a result of interactions with teachers and peers. This dissertation relied on both theories to analyze a single learning environment in which self- and social forms of regulation were present. Participants included sixty four students from a K-8 school whose residents are largely from low-income families. Students worked collaboratively to design and carry out a complex project with students who shared similar interests over a nine-week period. Students completed a number of survey instruments, and their group interactions were videotaped daily. Using qualitative and quantitative data analyses, I examined the strategies group members used to regulate their cognition, motivation, and behavior over the course of their project. Results of the quantitative Hierarchical Linear Modeling (HLM) analysis suggested that students' motivational orientations, prior SRL, and perceptions of task features predicted change in SRL over the nine-week period. Furthermore, coregulated learning scores moderated the relationship between (1) students' motivational orientations and their change in SRL, and (2) students' beginning and ending SRL scores. Finally, coregulation scores positively predicted groups' final assessment scores at the conclusion of the project. Results from the qualitative analysis suggested between group and within group differences in both the amount and type of processes groups used to self- and coregulate their cognition, motivation, and behavior over the course of their project. Theoretically, this research extends individual models of SRL to include social forms of regulation arguing that students acquire, refine, and use different forms of regulatory processes to regulate group interactions. Finally, given the emphasis on SRL throughout national and NJ state curriculum standards this research supports the use of high interest, collaborative tasks as an instructional method to increase students' regulatory processes.

ACKNOWLEDGEMENTS

Education is not the filling of a pail, but the lighting of a fire.

—William Butler Yeats—

I appreciate those who have nurtured and inspired me during my tenure in graduate school. To Dr. Angela O'Donnell, none of this would have been possible without you. Thank you for giving me the chance to pursue this path, challenging me to think deeply, and supporting me in every possible way. To Dr. Toni Kempler Rogat, I appreciate the time you have spent endlessly helping me conceptualize my ideas. For your thoughtfulness and guidance— I am forever grateful. To Dr. Cindy Hmelo-Silver, who has fostered my love of PBL and whose insight has helped framed my own ideas—thank you. Dr. Nancy Perry, thank you for your helpful feedback and assistance in crafting this dissertation. To my parents, you have instilled in me your passion for education—thank you for your constant support and for always believing in me. I love you. To Chris, you were there for me from the beginning— for the late nights reading (and rereading), the constant reassurance and encouragement, your unconditional love, and enduring wisdom—you inspire me.

CONTENTS

APPENDICES

TABLES

FIGURES

CHAPTER ONE

INTRODUCTION

Over the last twenty years the literature on self-regulated learning (SRL) has focused primarily on understanding the processes learners use to self-regulate and the subsequent benefits SRL has on learning and performance (Boekaerts & Niemivirta, 2000; Corno & Mandinach, 2004; Hadwin, Wozney, & Pontin, 2005; Perry, 1998; Pintrich & Zusho, 2002; Winne, 2001; Wolters, Pintrich, & Karabenick, 2005; Zimmerman, 1989; 1990; 2000). Based on a social cognitive theoretical framework, self-regulated learners are familiar with various cognitive and metacognitive strategies, and have the ability to select, monitor, and regulate their use of these strategies (Wolters, Pintrich, & Karabenick, 2003). SRL research has expanded models of self-regulated learning beyond a conceptualization of individuals' cognitive and metacognitive processes to include how students regulate motivation and behavior (Pintrich, 2000). Regulating motivation refers to processes employed in starting, maintaining, and finishing a particular activity or goal, while regulating behavior includes strategies to control time, effort, and helping behaviors (Corno, 2001; Newman 2000; Wolters et al., 2003). In general, findings suggest that students who more effectively regulated cognition tend to show higher levels of performance on tasks and achievement outcomes (Miller, Greene, Montalvo, Ravindran, & Nichols, 1996; Pintrich & DeGroot, 1990; Wolters & Pintrich, 1998).

Social cognitive models also suggest individuals have certain cognitive and motivational orientations (i.e., individual characteristics) that influence them as they self-regulate. Research on individuals' cognitive orientations has explored the relationship between SRL and one's domain specific knowledge or epistemology, while the literature on SRL and one's motivational orientations has included research on self-efficacy, attributions, goal orientations, values, and interest and one's SRL. Although I provide an in-depth discussion of these constructs in the literature review, in general, research has found positive, reciprocal relationships between these constructs and the amount and type of SR strategies individuals employ.

While social cognitive literature has certainly added to knowledge of the types of strategies individuals use to self-regulate, these models primarily focus on SRL as an individual activity, with the individual as the regulator of his or her behavior. Although these models have recognized the influence of the social context through modeling and feedback, they treat interpersonal, social, and/or cultural influences as separate factors and investigate how these factors affect students' SRL. As such, in the social cognitive framework a conceptualization of the social origins of self-regulation processes is limited (Martin, 2006).

Several researchers (e.g., Corno & Mandinach, 2004; Hadwin & Oshige, 2007; King, 1992; Järvela & Järvenoja, 2007; McCaslin & Hickey, 2001; Schunk, 2001) have begun to consider the social processes involved in how learners acquire and use SRL strategies to self-regulate. Instead of treating interpersonal, social, and/or cultural influences as separate variables that affect regulatory processes, sociocultural researchers argue that SRL is fostered, developed, and maintained (1) within social contexts and (2) as a result of interactions among teachers and peers. Thus, the development of self-regulated learning is conceptualized as a social as well as individual process.

Accordingly, sociocultural theories of SRL offer a new lens with which to examine how students potentially develop and refine SRL strategies and how such theories can be used to improve classroom practice.

In a sociocultural approach to SRL, researchers investigate how learners acquire SRL processes by interacting with a more “regulated” other (MRO) on a joint task. This process occurs as a MRO *coregulates* the learners’ cognition, motivation, and behavior (Hadwin & Oshige, 2007). This process is referred to as coregulation because the MRO temporarily *shares in* regulating the learner’s cognitive, motivational, and behavioral activities. As the learner gains increased competence using strategies to self-regulate, the MRO fades his or her level of support, and eventually the learner is capable of executing SRL strategies autonomously.

When multiple students work in a collaborative learning environment, it is possible to extend conceptualizations of coregulated learning to hypothesize how more than one group member can potentially share in regulating the cognition, motivation, and behavior of other group members. For example, group members may work together collectively in regulating group activities such as goal setting, monitoring, and evaluation. Equally likely are situations where each group member possesses different regulatory processes, some of which are better suited for certain tasks. Under these conditions the role of the MRO alternates among group members depending on whose regulatory strategy is best suited for the task. Thus, in a group context when students work together on a joint task, coregulation includes all of the following:

1. A single more regulated group member coregulates another group member(s),

2. The role of the MRO alternates among group members, depending on whose regulatory processes are better suited for a particular task, and

3. Several group members share together in regulating each other's regulatory activities simultaneously.

To reiterate, social cognitive and sociocultural theories differ in how they account for the social origins of SRL (Hadwin, & Oshige, 2007). Social cognitive theories suggest that a learner develops SRL by observing and emulating a model as the model applies a specific strategy to solve a problem (e.g., A learner observes as a teacher explains how to construct an outline). Then the learner practices using this strategy to regulate his or her own cognition, motivation, and behavior (e.g., the learner constructs his or her own outline following the steps explained by the teacher). With practice, the learner internalizes the strategy and eventually can apply it in multiple contexts and under various conditions. Sociocultural theories differ from social cognitive theories in *who* is doing the regulating (Hadwin, & Oshige, 2007). According to sociocultural theories, the MRO *regulates* aspects of the learner's cognition, motivation, behavior (e.g., a MRO constructs an outline with another student and both share in the process; by constructing an outline together, the learner is exposed to advanced strategies and is provided with opportunities to practice applying these strategies with support and guidance from the MRO). With repeated coregulated learning it is hypothesized that the learner will begin to internalize these processes and self-regulate independently. Therefore, in a sociocultural framework, the MRO assumes responsibility for regulating the learner, whereas in a social cognitive framework the learner is responsible for regulating his or her own cognition, motivation, and behavior.

Therefore, drawing on social cognitive and sociocultural theories, the current research proposed an integrative approach to conceptualizing regulation that may serve to further understand self- and coregulation processes. While the literature has placed a different emphasis on the role the social context played in the development of students' regulatory processes, the current research used both theories to analyze a single learning environment in which self- and social forms of regulation were present.

Collaborative learning contexts are one such context in which we may expect to see learners develop and use both self- and coregulated learning processes. Despite the large amount of literature on collaborative learning, little research has used this context to examine the development and use of self- and coregulatory processes simultaneously. However, collaborative learning environments are particularly appropriate for such an examination because students work on a joint task and in the process thinking strategies that are usually internal are potentially externalized and explicit and as a result available for the researcher to observe (Webb, Nemer, Chizhik, & Sugrue, 1995). Although collaborative learning environments may be appropriate environments to examine students' self- regulated learning and coregulated learning processes (Järvela & Järvenoja, 2007), collaborative learning techniques are not always appropriate, and not all groups are always productive (O'Donnell & O'Kelly, 1994). That said, some tasks are more likely to result in productive collaborative learning groups and increased use of SRL processes (Cohen, 1994; Perry, 1998).

According to the individual SRL research, tasks that are complex and personally meaningful can provide natural opportunities for students to apply and develop SRL strategies (Perry, 1998). Although this literature has focused on task characteristics that promote individual SRL, I propose these same task features can also promote coregulation when students work in a collaborative group setting. Complex, personally meaningful tasks are well suited to study the social origins of self- and coregulated learning because these tasks require students to work together coordinating multiple cognitive, motivational, and behavioral processes to construct various products. Furthermore, because complex, meaningful tasks potentially require students to use various forms of self- and coregulation in order to execute the task successfully, they create a potential context for students to develop and refine these skills, as well as for researchers to investigate these processes in practice. In addition to tasks being complex and personally meaningful, the literature on collaborative learning has also offered a number of other task features that lead to effective group interactions. According to that research, tasks that were (1) ill-structured, (2) based on important, intellectual material, (3) required positive interdependence and individual accountability, and (4) included a set of evaluative criteria to determine successful performance led to more effective collaboration among group members (Lotan, 2003).

As such, drawing on this literature, participants in this study worked collaboratively in groups of four on a task which required them to design and implement a project in an area related to all the group members' interests. Teachers facilitated this process by helping students narrow their areas of interest, formulate a plan, model appropriate information seeking strategies, and assess their projects. The nature of this task included a number of the characteristics suggested by the literature to support the development of, use of, and refinement of SRL strategies. For example, these projects were open ended in that there was no single correct way to proceed and no clear right or wrong answer. Because of the length of the projects and their complexity, students had multiple opportunities to contribute to the group and display various regulatory processes. Finally, projects were designed based on students' shared interests, and as a result, were hypothesized to be personally meaningful. As such, the task was designed so that students' projects were open ended, authentic, complex, and collaborative. As a result, I expected the context to help promote students use of self- and coregulatory processes.

Although research supports the claim that young learners self-regulate (Perry, 1998), not all kinds of regulation are equally effective, and not all learners regulate all the time (Winne, 1995; Perry & Winne, 2006). One possible explanation for this finding is that developmental changes account for differences in students' use of regulatory processes (Zimmerman, 1990). This research has suggested that as children grow older, they are better able to differentiate between different strategies, self-assess their abilities and motivational orientations, and monitor their learning (Pressley, Levin, & Ghatala, 1984). In this dissertation, I investigated this claim by examining peer groups that consisted of mixed-age and same-age students to discern whether differences existed between the degree to which they regulate their activities, and the types of strategies they used to do so. It may be that age-related changes in SRL explain differences in regulation, or alternatively, that self-report instruments used to measure young children's SRL are not appropriate for capturing distinctions in their regulation (Perry & Winne, 2006).

SRL is an internal process and consequently, researchers must draw inferences about cognitive operations that they cannot directly observe (Webb, Nemer, Chizhik, & Sugrue, 1995). As a result, researchers have primarily relied on self-report measures as measures of students' regulatory processes. Although self-report data have added significant knowledge about students' perceptions of their SRL to the literature, a complete reliance on self-report data raises validity issues as to the extent to which students' perceptions reflect their actual performance (Perry & Winne, 2006). For example, Winne & Jamieson-Noel (2002) found low calibration between students' trace measures of SRL and their self-reported SRL. Because self-report measures can be considered one indication of students' self-monitoring skills, more research is needed to discern the relationship between students' actual and students' self-reported SRL (Zimmerman, 2008). This dissertation included qualitative analyses of group interactions with quantitative measures of students' SRL reports to triangulate data about students' self-regulation processes. While sample sizes in the qualitative analysis were too small to make any reliable generalizations, it is hoped that the research findings will encourage further investigation into the consistency between students' self-reported and observed SRL.

Finally, students in urban school districts face challenges that students in the majority of suburban school districts do not (Seiler & Butler, 2005). This includes deteriorating physical conditions, broken or outdated equipment, limited resources, frequent instances of violence, increased teacher turnover rates, and high student to teacher ratios (Seiler & Butler, 2005, Oakes, 2000). Urban students are also less likely than their middle/upper middle class counterparts to possess the self-regulatory skills and knowledge demanded by colleges, employers, and trade schools to succeed (NRC, 2003). The research on urban education has found classrooms are primarily teacher-centered and achievement is based on behavioral skills and fixed knowledge (Oakes, 2000).

Furthermore, the research has suggested that students spend considerable time completing worksheets and reading from textbooks. Overall, rather than tasks that require students to be active learners, there is a culture of rote memorization in which students are passive learners (Oakes, 1999). Finally, the higher student-teacher ratios that characterize urban schools make it difficult to implement traditional training programs aimed at increasing students' regulation. As a consequence, researchers must look to other instructional designs to help students in urban schools develop and practice self-regulatory skills. Because over 20% of students in the United States attend urban schools more work is needed to improve urban education in our country (Oakes, 1999). Specifically, using peers to develop regulatory skills may mitigate limited resource demands in urban schools due to high student-teacher ratios by capitalizing on students' ability to teach one another regulatory strategies (NRC, 2003).

Thus, this dissertation addressed the following questions:

1. Does participation in same or mixed- age groups predict students' reports of their SRL at the end of the project, after controlling for prior SRL?
2. Do motivational orientations, prior SRL, coregulation, final project assessment, and/or features of the intervention predict post-test scores of individuals' reports of SRL?
3. In a purposeful sample of four groups, what self- and coregulated processes do students use to regulate aspects of their cognition, motivation, behavior?
4. For the groups analyzed in question 3, how consistent are students' reports of their self-regulated and coregulated processes with their observed regulation processes?

As background to the proposed study, Chapter two discusses the relevant literature and theoretical background for this study. This includes a discussion of social cognitive theories and sociocultural theories and a proposed integrated approach as the theoretical basis of this research. Also in Chapter two, I review the research on task characteristics that support SRL, group processes that lead to the development of SRL, and my rationale for same and mixed-age grouping. Chapter three presents an in-depth discussion of the methodology. In Chapter four, I present the quantitative analysis, drawing on Hierarchical Linear Modeling as the primary statistical analysis used to investigate this data. Chapter five reviews the qualitative findings of this dissertation. Finally, Chapter six includes the discussion section, limitations, and educational significance of this research.

CHAPTER TWO

LITERATURE REVIEW

Self-regulation refers to individuals' capacity to be cognitively, motivationally, and behaviorally active participants in their own learning endeavors (Zimmerman, 1989). Traditionally, researchers have examined SRL processes from a social cognitive perspective emphasizing the active role individuals assume in regulating their own cognition, motivation, and behavior. This research has focused on how individual characteristics of the learner affect SRL processes, and how learners use various strategies to regulate their cognition, motivation, and behavior. These models recognize the influence of the social context through modeling and feedback, accounting for interpersonal, social, and/or cultural influences as separate factors that possibly affect students' SRL (Martin, 2006). Sociocultural theories, on the other hand, argue that SRL is fostered, developed, and maintained within social contexts and as a result of interactions with teachers and peers. Originally based on Vygotsky's work, sociocultural theories investigate SRL by examining how individuals learn and refine SRL strategies by working with an individual with high SRL (i.e., MRO) on shared tasks through the process of coregulation. Expanding sociocultural theories to a collaborative group context, coregulation can take on many forms including (1) a single more capable group member coregulating another, (2) each group member taking on the role of MRO depending on the strengths of a particular learner, or (3) several group members sharing together in regulating the groups' activities. Drawing on social cognitive and sociocultural theories, this research suggests that both theories may be helpful in understanding how students develop, use, and refine regulatory processes within a collaborative context. As such, the goal of this literature review is to discuss social cognitive and sociocultural theories of SRL and then offer a combined approach to investigating regulatory processes in group contexts as the theoretical basis of this research. Then I will present the research on collaborative learning, task characteristics that support SRL, and a rationale for mixed-age grouping.

Social Cognitive Models of Self-Regulation Processes

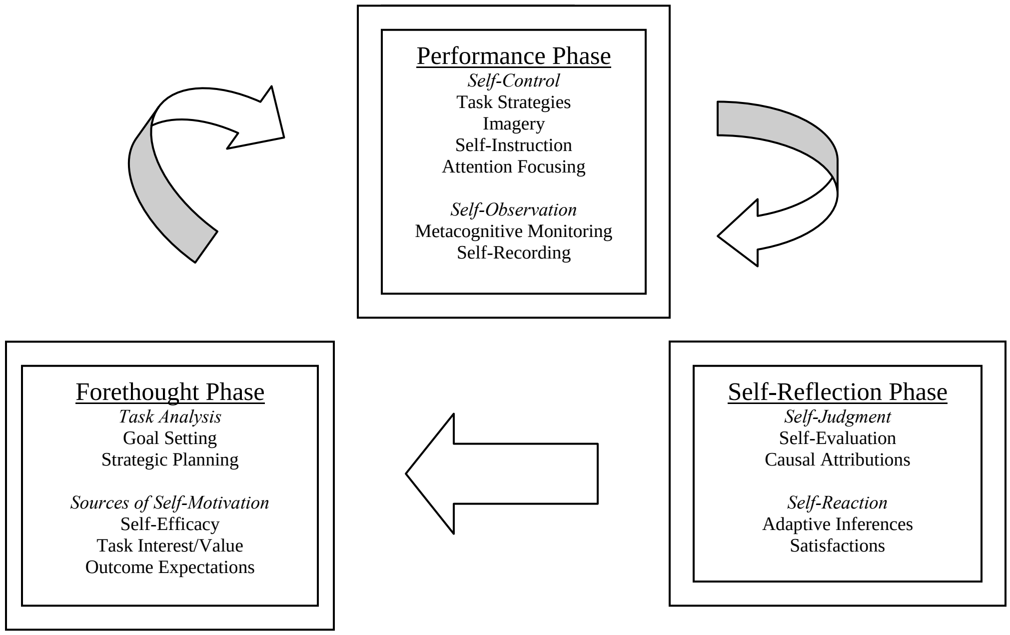
All social cognitive theories share several common characteristics. First, individuals actively construct knowledge as they learn. Second, learners have certain cognitive, motivational, and behavioral orientations (i.e., individual characteristics) that they bring to bear on the task as they self-regulate and that affect SRL processes. Third, individuals initiate and use a number of self-regulating strategies (also referred to as processes) to regulate their cognition, motivation, and behavior. Fourth, individuals have criteria, standards, or goals against which they compare performance to determine if modifications are needed. Finally, SRL mediates the relationships among an individual’s orientations, environmental characteristics, and achievement (Pintrich & Zusho, 2002). The current research was based on three social cognitive models of SRL: Zimmerman’s (1989) model of SRL processes, Winne and Hadwin’s (1998) model of how individuals regulate cognition, and Pintrich’s (2000) model of SRL processes and areas of SRL.

Zimmerman’s Model of SRL

Zimmerman’s (1989, 2000) model is a theoretical description of self-regulation as three subprocesses (i.e., forethought, performance control, and self-reflection) that interact reciprocally to constitute SRL (Figure 2.0).

Figure 2.0

Zimmerman's (1989) Model of Self-Regulation Processes



The forethought phase describes planning processes an individual uses to set the stage for action such as goal setting and modeling. These processes occur before an individual takes any action toward his or her goals. The forethought phase "involves a number of motives to self- regulate such as self-efficacy beliefs, outcome expectations, task interest or value, and goal orientation as well as two key self-regulatory processes: goal setting and strategic planning" (Zimmerman, 2002, p. 68). The performance control phase involves processes an individual initiates during learning and which affect attention and action toward meeting his or her goals. These may include the use of social comparisons, feedback, or various learning strategies. Finally, the self-reflection phase refers to processes the learner uses to evaluate his or her goal progress and strategies. The sub-processes are reciprocally related, in that forethought processes affect performance control processes, which in turn affect self-reflection processes, which in turn affect forethought and performance control processes.

This cycle of forethought, performance control, and self-reflection, illustrates the typical self-regulatory processes associated with regulating cognitive processes involved in learning. This model accounts for the role individuals' motivational orientations serve in SRL by acknowledging their influence on the cognitive SRL processes just described. For example, individuals with high self-efficacy orientations set more challenging and realistic goals, and are better at monitoring their strategy use (Zimmerman, 2002). However, the model does not elaborate on how individuals regulate other areas of learning including motivation and behavior, nor does it provide a specific explanation of SRL processes.

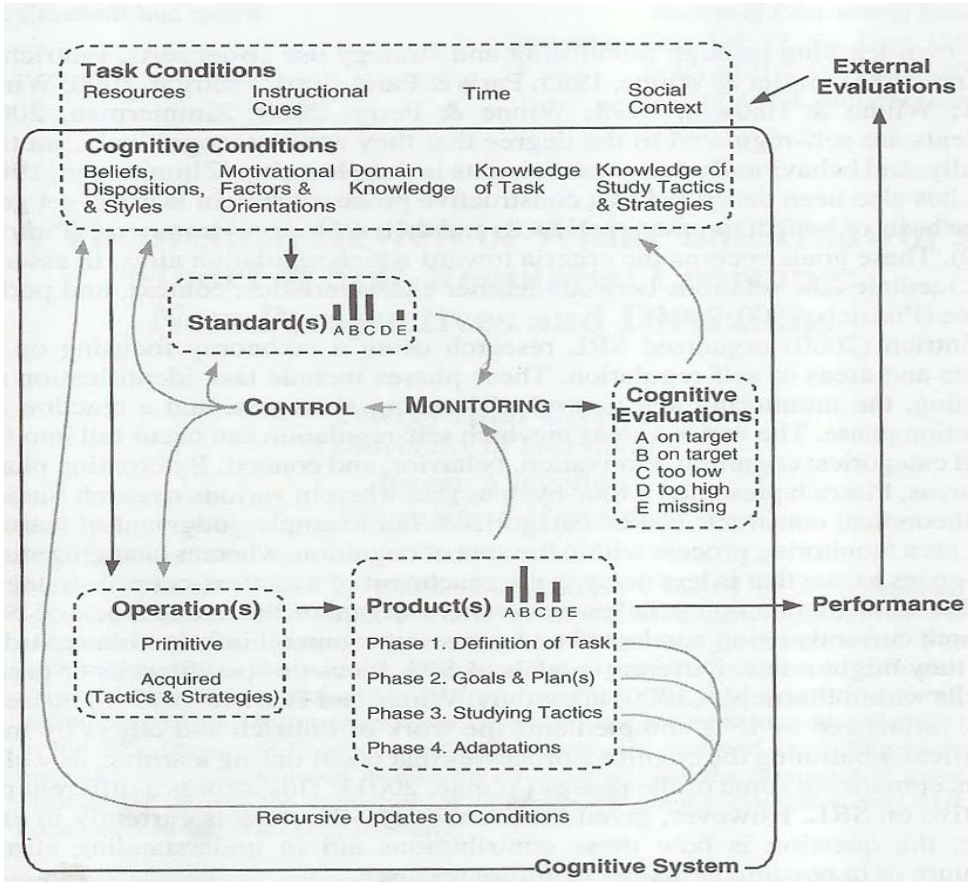
There is some research that supports this model. For example, Zimmerman (2008) found a positive relationship between students' self-efficacy and the performance goals students set for themselves. There was also a positive relationship between students' self-efficacy perceptions and students' final grades (Zimmerman & Bandura, 1994). Similarly, the researchers found a positive relationship between outcome attributions and self-reported outcomes in the performance phase and feelings of satisfaction and outcome attributions in the self-reflection phase. Finally, self-reflection feelings of satisfaction and students' writing performance positively predicted self-efficacy and task interest—both elements of the forethought phase (Zimmerman & Kitsantas, 1999).

Winne and Hadwin's (1998) SRL Model

Winne and Hadwin's (1998) model of SRL is an expanded model of how students regulate their cognition (Figure 2.1).

Figure 2.1

Winne and Hadwin's Model (1998) of Self-Regulation Processes



This model differs from the aforementioned model in that it differentiates the process of task definition from goal setting/ planning, and it uses information-processing techniques to explain regulatory processes during learning. According to the model, SRL processes (i.e., planning, monitoring, control, and evaluating) regulate the interaction among an individual's conditions, operations, products, evaluations, and standards as he or she works toward defining the tasks, establishing goals and plans, utilizing study tactics, and engaging in metacognitive adaptation (Winne, 2001).

Conditions. Conditions are cognitive and motivational orientations (e.g., high self-efficacy, positive attributions) individuals have available for learning, as well as the task conditions that may support or constrain learning. The first type, cognitive conditions, includes beliefs and dispositions, motivational factors and orientation, domain-specific knowledge, knowledge of task, and knowledge of study tactics and strategies. These are characteristics inherent to the learner or learned from prior experiences (Winne, 2001). The model suggests that conditions affect operations and products directly and have an indirect affect on monitoring/ control processes via one's standards. More time spent on defining the task (phase I) and establishing goals and plans (phase II) results in a better match between students' predicted (i.e., standards) and actual performance (Greene & Azevedo, 2007).

For example, efficacy expectations influence standards in phase II (i.e., establishing goals and plans) and operations in phase III (i.e., utilizing study tactics). Moreover, higher degrees of self-efficacy are related to goal selection and decisions whether to participate and persist in tasks (Winne, 2001). During phase IV, individuals modify self-efficacy beliefs as they evaluate predicted and actual performance. The model posits that unsuccessful performance is more likely to affect efficacy beliefs when individuals begin with high expectations than when performance expectations are initially low (Winne, 2001).

Beliefs and dispositions regarding one's knowledge should also affect standards (Winne, 2001). For example, learners who possess more mastery-oriented beliefs should create goals based on the premise that effort leads to successful performance (Greene & Azevedo, 2007). Furthermore, if students believe effort relates to performance, they should be more inclined to persist when strategies fail in phase III (i.e., utilizing study tactics). Finally, beliefs can affect metacognitive adaptation in phase IV (Winne, 2001). If students possess an entity view of intelligence (Dweck, 2000), they may be less likely to modify beliefs when they perform poorly.

Task conditions, the second type of conditions, are characteristics of the external environment and include resources, instructional cues, time, and the social context. For example, Winne and Hadwin's (1998) model may help explain the conflicting research findings pertaining to the relationship between time and regulation (Greene & Azevedo, 2007). For example, choosing to study only easy information after phase I (i.e., task definition) may result from perceived cognitive and task conditions being unfavorable, where the same action performed after phase III (i.e., applying learning strategies) may indicate use of a strategy to make the most efficient use of time (Greene & Azevedo, 2007).

Standards. Standards represent individuals' perceptions of how each stage should optimally end (Winne, 2001). Students develop standards based on what information is needed for learning (i.e., metrics) as well as their beliefs about studying. Standards eventually develop into goals, which become the primary means upon which individuals determine if they are successful (Winne, 2001).

Operations. In contrast, operations are cognitive information processing functions that occur while learning. These include less sophisticated memory processing and retrieval processes, as well as use of more complex strategies. Memory processes include searching memory, monitoring how new information compares with prior knowledge, assimilating knowledge, rehearsing information in order to remember it, and changing knowledge learned in one form (e.g., verbal) to another (e.g., pictorial) (Winne, 2001). Operations in each phase result in products for that phase. For example, in phase I, products may include a clear definition of the task, whereas a viable product for phase II may entail setting goals or a plan for solving phase III (Winne, 2001).

Monitoring. Cognitive monitoring is the process by which individuals compare products with standards to establish whether goals are met. When individuals are dissatisfied with the relationship between standards and performance, they may exercise control over learning operations to modify products, revise conditions and/or revise standards, or give up (Greene & Azevedo, 2007). Monitoring also occurs at the metacognitive level as learners monitor SRL processes. Typically, students make use of information about a particular learning task (e.g., “This problem is easy.”) to create standards in phase II. Standards are then compared to performance in phase III to determine appropriate strategies for problem-solving. If during phase III, individuals realize that task difficulty is not as anticipated (i.e., metacognitive monitoring), they may initiate a metacognitive control strategy to modify standards in phase II. Thus, monitoring the relationship between performance and standards can lead to modifications to previous phases in the model (Greene & Azevedo, 2007).

To review, while SRL process cycles may differ by individual and/or tasks, typically the process begins with a clear definition of the task, followed by the production of goals and plans to accomplish them. Based on the results of phases I and II, individuals develop learning strategies and products. Self-regulated learning processes occur throughout the process as individuals compare standards with products, beliefs, efficacy, and time constraints. If differences arise, individuals may react immediately by modifying task and/or cognitive conditions. However, if differences continue over the long-term individuals may form more permanent changes to their conditions and strategies. While memory capacity may limit the effectiveness of these processes (Paas & Kester, 2006), as automaticity develops (Logan, 1988) students are able to perform multiple steps of a strategy in one memory unit. Thus, Winne and Hadwin's (1998) model not only elaborates on the SRL strategies involved in cognitive functioning; it also illustrates the recursive nature of SRL processes guided by effective monitoring and control activities (Greene & Azevedo, 2007). Because individuals regulate areas other than their cognition, it is important to examine other theoretical models that account for how students regulate their motivation and behavior.

Pintrich's (2000) SRL Model of Processes and Areas of SRL

Pintrich's (2000) model modifies the aforementioned models in two ways. First, it divides Zimmerman's (1989, 2000) performance phase into monitoring and control processes, and second, it discusses strategies individuals use to regulate other areas of learning including motivation, behavior, and aspects of the context (Table 2.0).

Table 2.0

Pintrich's (2000) Model of Self-Regulation Processes

	Areas for Self-Regulation			
Phases	Cognition	Motivation	Behavior	Context
Phase I: Forethought, Planning, and Activation	o Target goal setting o Prior content knowledge activation o Metacognitive knowledge activation	o Goal orientation adoption o Efficacy judgments o Perceptions of task difficulty o Task value and interest activation	o Time and effort planning o Planning for self-observation of behaviors	o Perceptions of task o Perceptions of effort
Phase II: Monitoring	o Metacognitive awareness o Monitoring of cognitions	o Awareness and monitoring of motivation and affect	o Awareness and monitoring of effort, time use, need for	o Monitoring and changing task or context conditions

			help o Self-observation of behavior	
Phase III: Control	o Selection and adaptation of cognitive strategies for learning and thinking	o Selection and adaptation of strategies for managing motivation and affect	o Increase/ decrease effort o Persist, give up, seek help	o Change or negotiate task o Change or leave context
Phase IV: Reaction & Reflection	o Cognitive judgments o Attributions	o Affective reactions	o Choice behavior	o Evaluations of task o Evaluation of context

SRL processes in this model include planning, monitoring, control, and reflection. Planning refers to strategies individuals use to organize and prepare for the upcoming task. Self-monitoring activities describe self-regulatory strategies individuals use to evaluate their performance with their standards or learning goals. In response to information gathered during the self-monitoring phase, individuals initiate control-related activities (Pintrich, 2000). It is important to note that operationally it is difficult to distinguish monitoring activities from control activities since the activities associated with these processes are quite similar (Pintrich, 2000). Reflection or reaction is the last phase in Pintrich's model and includes strategies individuals use to evaluate whether they should continue, modify, or cease their actions.

Students can apply SRL strategies (i.e., processes) to regulate four areas related to their learning: cognition, motivation, behavior, and context (Montalvo & Torres, 2004). Although regulatory processes within each area often occur linearly, they can occur simultaneously and/or dynamically, and in some instances processes may become automated and outside of the individual's consciousness (Winne & Hadwin, 2006).

Regulating cognition. Regulating cognition refers to cognitive and metacognitive processes (i.e., strategies) individuals employ to adapt and change their cognition during learning (Wolters, Pintrich, & Karabenick, 2003). Planning processes include setting goals, activating prior and metacognitive knowledge, recognizing the difficulties in a particular task, and identifying the relevant knowledge and skills to address the task. Self-monitoring strategies for regulating cognition refers to metacognitive awareness and describes how students monitor their understanding ("I need to slow down, speed up, etc.). These processes provide real-time information to the individual about the relative discrepancy between his or her goals and current progress toward that goal. Individuals also use control-related strategies to regulate cognition. These include the selection and utilization of thought control strategies such as cognitive and metacognitive strategies (e.g., elaboration, organization). Here, individuals may utilize strategies such as imagery, mnemonics, paraphrasing, outlining, networking, and note taking to help them encode newly learned information into working memory (Weinstein & Mayer, 1986). Finally, individuals regulate cognition using reflection processes. These strategies help the individual form judgments and evaluations of the success of their performance by comparing it to previously established standards/goals.

Regulating motivation. In addition to regulating their cognition, students can also regulate their motivation (Wolters et al., 2003). Regulating motivation refers to processes individuals employ to start, persist, and finish a particular activity or goal (Wolters et al., 2003). Planning processes used to regulate motivation include activation of stored motivational beliefs (e.g., judgments of self-efficacy, goals, perceived task value, and/or interest). Individuals also employ self-monitoring processes to regulate motivation. These describe strategies individuals use to help them become aware of their motivational patterns (e.g., “Do I feel confident performing this task? Do I value this task”). Motivational strategies and strategies of emotional control are control strategies aimed at regulating motivational processes. This includes the selection and adaptation of strategies such as mastery self-talk that students can draw upon to regulate their motivation. Finally, individuals use reflection processes to evaluate how well they are regulating their motivation and meeting their goals.

Regulating behavior. Pintrich's (2000) model also illustrates how individuals use self-regulatory processes to observe their own behavior, and monitor, regulate and control it. Here, planning processes used to regulate behavior may include estimating the time and effort one will need to complete a task. Individuals use self-monitoring strategies to monitor their effort, time use, and need for help in relation to their goals and task difficulty (Pintrich, 2000). Depending on information gathered during the monitoring phase, individuals may choose to modify their behavior by setting time limits or focusing attention toward tasks that can be completed in the time allotted (Wolters et al., 2003). Finally, individuals use reflection strategies to evaluate their performance related to their goals and this information informs future planning activities.

Regulating context. Finally, individuals can regulate certain aspects of the environment using a number of SRL strategies. First, planning processes include activating prior knowledge to form perceptions of the task, the contextual environment, and the effort needed in the current task. Furthermore, individuals use self-monitoring processes to regulate aspects of the external environment taking into account what class rules exist, how performance is evaluated, reward and punishment systems, teacher behavior, and so on. Control-related activities aimed at regulating the context are linked to activities that structure parts of the environment within the students' control such as changing aspects of the task or redesigning a particular part of environment. Finally, reflection processes help individuals regulate their contexts by creating self-assessment information related to how one is performing given his or her current environmental surroundings. These reflection processes serve as an indication as to whether to continue, modify, or cease one's actions (Winne & Hadwin, 2006).

To review, I have explored three social cognitive theories of SRL that focus on how individuals employ certain processes in order to regulate aspects of their cognition, motivation, and behavior. Zimmerman (1989, 2000) and Winne and Hadwin's (2006) models depict how individuals' regulate cognition, while Pintrich (2000) extends SRL theory to include how individuals regulate motivation, behavior, and aspects of the context. Furthermore, because each theory recognizes the role individual characteristics (i.e., orientations) play in one's SRL processes, I will now review individual cognitive and motivational characteristics that are important precursors affecting an individual's SRL. Due to space constraints, I selected what I believed to be the most relevant constructs to discuss here. These include self-efficacy, attributions, goal orientations, values, interest, domain specific knowledge, and epistemologies. It is important to note that some of these variables have also been identified as mediators and outcomes of SRL (Zimmerman & Schunk, 2008). However, in this research these variables were conceptualized as precursors to SRL.

The Relationship between Individual Characteristics/ Orientations and SRL

Self-Efficacy

Self-efficacy is one type of motivational orientation that describes an individual's belief in his or her ability to perform a task successfully (Bandura, 1986). Self-efficacy beliefs develop as individuals compare task demands with their current knowledge, skills, and strategies that are relevant to the task (Schunk & Zimmerman, 2007). As they interpret this comparison, individuals create and develop beliefs about their ability to engage in the task and similar future tasks (Pajares, 2006). In turn, these beliefs have the power to influence future choice of activities, effort, expenditure, persistence, and achievement (Schunk & Zimmerman, 2007).

Self-efficacy beliefs are especially important to examine because they affect many of the processes involved in self-regulation (e.g., setting goals, self- monitoring, and self-evaluation) as well as academic performance in general (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996, 2001). First, self-efficacy beliefs contribute positively to one's choice of goals (Zimmerman & Cleary, 2006); and some form of goal-setting process is the first step in SRL models. When an individual possesses high self-efficacy during a particular task, he or she is more likely to develop challenging and specific goals (Bandura, 1986; Zimmerman, Bandura, & Martinez-Pons, 1992). For instance, Cleary and Zimmerman (2001) have examined expert, non-expert, and novice adolescent basketball players' levels of self-efficacy and self-regulation for completing two free-throw shots in a row. Before doing so, participants recorded their degree of self-efficacy and their performance goals. Results suggested that individuals with greater reported efficacy provided more specific goals (e.g., "I will make 10 of 10 possible baskets") whereas participants with lower degrees of efficacy gave vague goals (e.g., "to make baskets"). Challenging and specific goals aid self-regulation by helping the learner evaluate his or her progress, while keeping in mind the overall objectives of the task (Zimmerman & Cleary, 2006).

Furthermore, if an individual has high self-efficacy in a given task, he or she is also more likely to use more strategies and to apply new strategies when previous ones are unsuccessful (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996, 2001). Strategies refer to conscious actions individuals employ in order to gain knowledge or skills (Zimmerman & Cleary, 2006). Recent research has suggested a causal relationship between self-efficacy and effective strategy use in that students with higher degrees of self-efficacy were more likely than students in the control condition to use more cognitive and metacognitive strategies regardless of their level of achievement or ability (Schunk & Rice, 1991). Moreover, research by Schunk and Swartz (1993) has found that students with high degrees of self-efficacy were significantly more likely to continue using writing strategies on transfer tasks compared to students with a lower degree of self-efficacy. Finally, students with higher degrees of self-efficacy were also more likely to use more effective self-regulatory strategies (Zimmerman & Schunk, 2008).

Self-efficacy is also an important characteristic of SR learners because it affects monitoring. Monitoring allows individuals to distinguish whether they are correct, made errors, and/or misunderstood the material (Zimmerman & Cleary, 2006). Schunk (1983) has suggested that individuals with high self-efficacy are more likely than students with low self-efficacy to self-monitor, and are better at monitoring their learning than those with lower self-efficacy. Similar results have argued that junior high and high school students with higher degrees of self-efficacy monitored their time more effectively and were more persistent (Bouffard-Bouchard, Parent, & Larivee, 1991). In fact, Zimmerman and Schunk (2008) have stated that "high efficacy students monitored their academic work time more effectively, persisted longer when confronted with academic challenges, were more reluctant to reject correct hypotheses prematurely, and solved more conceptual problems than students with low self-efficacy" (p. 11).

It is important to note that the relationship between goals, strategy use, monitoring, and one's self-efficacy is reciprocal, meaning that individuals use these constructs as information in forming and evaluating their efficacy (Bandura, 1986). For example, research by Schunk (1998) has found that explicitly teaching students various SRL processes led to increased in self-efficacy and academic achievement.

Attributions

Attributions are one's perceptions of the causes of his or her academic success and failure and are also another important motivational construct associated with SRL (Weiner, 1992). The most commonly researched performance-related attributions are ability (e.g., "I did well because I am smart); effort ("I did well because I studied"); and task ease or difficulty and luck. Weiner (1992) has suggested that attributions vary along three causal dimensions—internal or external to the person, stable or unstable over time, and controllable or uncontrollable. Ability is generally viewed as internal, stable, and uncontrollable, while effort as internal, changeable, and controllable (Weiner, 1992).

Attribution theory is important to SRL because effective self-regulators construct positive attributions and positive attributions promote self-efficacy, support motivation, and determine how one evaluates his or her progress at meeting goals (Schunk, 1994). If students doubt their ability to complete a task, they may abandon strategies early and become unmotivated to continue working. In turn, students who attribute causation to internal, unstable, and controllable methods are more motivated to self-regulate (Schunk & Zimmerman, 2008). Furthermore, positive attributional styles are correlated with better performance, more help-seeking behavior, higher performance expectations, and SRL activities such as forming challenging, specific goals and use of learning strategies (Peterson, 1990). In a study by Schunk and Gunn (1986), the researchers found that when students formed positive attributions related to ability (i.e., success is related to ability), this had a positive correlation with their self-efficacy beliefs. On the other hand, attributions attributed to luck (i.e., success is related to luck over which the student has no control) were negatively related to students' self-efficacy beliefs. Self-efficacy beliefs in turn significantly predicted students' use of various task strategies. Fortunately, some empirical research has suggested instructional techniques helped students form a positive attribution style (Weiner, 1994, 2000).

Goal Orientations

While terminology may differ slightly with different models, in general, goals are classified as either mastery- or performance oriented (Pintrich, 2000). Mastery goal-oriented students are motivated because they want mastery, understanding, and skill, and believe that ability is a result of increased effort (Pintrich, 2000). Furthermore, mastery-orientated students define success as improvement, progress, or mastery, and view errors as part of the learning process. Performance goal-oriented students, on the other hand, engage in tasks to demonstrate that they can perform better than other students or to seek approval from parents, teachers, or peers (Zimmerman, 2006). In general, these students hold an entity view of ability, believing that competence is inherited or fixed. As a result, they exert effort only as a means to demonstrate one's ability or self-worth and they define success as high grades or performance compared to others (Pintrich, 2000). While the purpose of a performance goals orientation is to "gain positive judgments of personal competence," the purpose of a learning or mastery goal orientation is to "increase one's competence" (Zimmerman & Schunk, 2008, p. 6). When students are confident learners, a performance goal orientation will lead them to search for opportunities to prove their intelligence. For unconfident learners, on the other hand, a performance goal approach will lead to feelings of helplessness. When students adopt a mastery-oriented approach, they will seek ways to improve their abilities regardless of whether they are confident or unconfident learners (Zimmerman & Schunk, 2008).

Research on goal orientation is important to SRL research because students with mastery goal orientations show greater use of constructs involved in SR (Pintrich, 2000). For example, students with mastery goal orientations were more likely to engage in monitoring their comprehension during reading exercises, made use of more elaboration and organization strategies while studying, exhibited higher levels of self-efficacy and positive attributions, and engaged in more help-seeking behavior (Pintrich, 2000; Wigfield et al., 2006). Similarly, research by Meece, Blumenfeld, and Hoyle (1988) found that science students with mastery goal orientations compared to students with performance-orientations reported greater use of metacognitive strategies (e.g., reviewing the confusing material, seeking assistance by asking questions, planning, organizing material), and were less likely to engage in the activity for superficial reasons (e.g., cheating, guessing, copying). Finally, mastery goal-oriented students not only reported greater use of SRL activities (e.g., strategy use), they also exhibited use of deeper processing strategies like being able to distinguish important information from less important information, assimilating new information with prior knowledge, and metacognitive monitoring (Yamauchi & Tanaka, 1998). This finding was supported by research by Grant and Dweck (2003) who found that students who adopted mastery goal orientations used more deep learning strategies than students with performance goal orientations.

Values

Task values are the incentives or reasons for doing the activity (Wigfield, 2000). Values are acquired through basic social learning processes and interactions with (or observation of) significant persons in an individual's life, cultural/ religious institutions and the media. As individuals come to value specific qualities such as status, money, or autonomy, they regulate cognition, motivation, and behavior in order to satisfy these values (Eccles et al., 1983).

There are four types of values in Eccles et al.'s (1983) model: attainment, intrinsic, utility, and cost. Attainment value results from tasks in which individuals believe successful performance is important. This concept is related to research on self-schemas, in that, individuals typically engage in tasks that confirm beliefs about their abilities (Wigfield & Eccles, 2002). For example, to the extent that an individual believes he or she is a master athlete, he or she will derive value from tasks that confirm aspects of this self-schema. Intrinsic value is the satisfaction one receives from participating in an activity or the personal interest one has in the subject matter. Therefore, if an individual enjoys reading, he or she is more likely to participate in a poetry club rather than a math club. Utility value is engagement in a task not because of the individuals' personal interest in the activity, but because the task relates to his current or future goals. An example of task utility value would include completing biology classes in order to pursue a career in physical therapy. Costs can either be defined as the negative features of participating in a given task or the level of effort one has to invest to be successful compared to the opportunity loss of not engaging in an alternative task (Wigfield &

Eccles, 2002). In other words, the choice to engage in certain activities will limit one's ability to participate in other activities.

Pintrich (1989) found greater relations among values, strategy use, and self-regulation than among self-efficacy, strategy use, and self-regulation. Furthermore, using regression techniques, Pokay and Blumenfeld (1990) found that values affected performance indirectly through strategy use. Moreover, values determined whether students chose to use different cognitive strategies in the first place. These findings were echoed by Pintrich and DeGroot (1990) who found that task values had a positive correlation with middle school students' use of cognitive and other SRL processes. Similarly, Wolters and Pintrich (1998) reported that 7^{th} and 8^{th} grade students who valued the task possessed deeper cognitive processing and more SRL strategies to regulate their learning.

Research exploring the relationship between values and self-regulation in young children has focused primarily on the affect of task values on cognitive strategy use. This research has utilized a combined measure of task value rather than testing each task value subscale independently (Wigfield et al., 2006). This is because while factor analysis on high school students' values suggested a four-factor model, younger students' values reduced to a one-factor model (Eccles & Wigfield, 1995). This suggested that young children may not differentiate among the four components of Eccles model and instead focused solely on their level of enjoyment on the task as a measure of overall task value (Eccles & Wigfield, 1995). Using a single factor task-value component, research suggested students with high levels of values reported using a greater number of cognitive strategies and more elaborate self-regulation strategies on the MLSQ compared to students with low levels of task values (Pintrich, 1989).

Qualitative research on young children (grades 2 and 3) suggested that while quantitative measures of value suggested a one-factor model, qualitative analysis of students' responses to open-ended questions regarding their values indicated distinctions in what they feel is important. In one research study, for example, interviews with students revealed a number of values including intrinsic interest in the task, desire to work on challenging projects, and a need for personal mastery (Perry, 1998).

Interest

Interest is illustrated by an individual's attention, concern, and/or curiosity in a given domain (Krapp, 1999). Interest is a reflection of one's feelings ("I feel excited to learn about fractions") and his or her values. Researchers have classified interest as either personal or situational (Hidi & Harackiewicz, 2000). Personal interest aligns with traditional conceptions of interest. It refers to a relatively stable motivational orientation that develops in an individual over time toward a particular subject matter, activity, or task. Generally, personal interest is related to increased knowledge, value, and affects (Renninger, 1990, 1992, 1998). Situational interest refers to interest that develops because of conditions in the task and/or the environment (Hidi & Harackiewicz, 2000). Here, interest is a more context-specific, immediate positive or negative response to particular environmental factors that may, or may not, last (Hidi, 1990). Because researchers hypothesize that increased knowledge, value, and affects only develop when situational interest continues (Hidi & Harackiewicz, 2000), researchers interested in situational interest are concerned with examining the features of the environment that will sustain interest.

The relationship between personal interest and certain self-regulatory functions is reciprocal. Research suggested that when students read material that interests them, they demonstrated greater comprehension and deeper processing (Krapp, 1999). There is also some evidence to suggest that interest resulted in greater attention, use of more advanced learning strategies, and positive affective states (Krapp, 1999; Renninger et al., 1992). Studying the relationship between interest and SRL, Schierfele (1992) found that college students who were interested in the text used more elaborate learning strategies and processed the information at a deeper level, compared to students who were less interested in the text materials.

Research on situational interest suggested that the degree to which individuals "feel like" engaging in a particular task affected their motivation to perform goal-directed actions (Sansone & Smith, 2000). They suggested that interest became the primary motivator for students to self-regulate, especially over long periods of time (Harachiewicz, Barron, Tauer, Carter, & Elliot, 2000). However, the research in this area is limited and requires further explanation to reach any conclusive positions.

Domain Knowledge

Alexander (1997) posits a theory of how domain knowledge influences interest and strategy use, and how this relationship ultimately leads to increases in performance. In particular, individuals move through three stages of development during academic tasks. In the acclimation stage, knowledge and interest are low, and learners apply surface level strategies in order to accomplish their goals (e.g., re-reading material) (Alexander, Sperl, Buehl, Fives, & Chiu, 2004). As students acclimate, they enter the competence stage in which interest and knowledge increase and they draw on more complex, deep-level strategies to learn (e.g., re-framing the problem) (Murphy & Alexander, 2002). Finally, knowledge, interest, and deep-level strategy use are all high as students enter the proficiency stage. Consistent with Siegler's Overlapping Wave theory, there has been some evidence of deeper level strategy use in the acclimation stage and surface-level strategy use during the proficient stage. However, this finding only lends support to the proposition that SRL is highly domain specific (Greene & Azevedo, 2007).

Epistemology

An individual's personal epistemology, or how they view the nature and source of their knowledge, is also an important characteristic of SR learners (Hofer & Pintrich, 1997). Research has suggested that more sophisticated beliefs about knowledge are correlated with increased academic performance (e.g., reading comprehension) (Schommer, 1990), test performance (Schommer, Crouse, & Rhodes, 1992) and overall college success (King & Kitchener, 1994). Furthermore, research by Butler and Winne (1995) found that highly developed beliefs may mediate the relationship between task conditions and learners' cognitive and motivational strategy use.

To review, consistent with social cognitive models, individuals have a number of cognitive and motivational characteristics that they have available for learning and that affect their SRL processes. I examined the most researched constructs including self-efficacy, attributions, goal orientations, values, interest, domain specific knowledge, and epistemologies. Now I will discuss a theory of SRL based on sociocultural principles and research, drawing attention to how it is distinguished from social cognitive theories.

Sociocultural Theories of Self-Regulated Learning

Sociocultural theory provides a useful framework for investigating social processes involved in SRL (Corno & Mandinach, 2004; Hadwin & Oshige, 2007; King, 1992; Järvela & Järvenoja, 2007; McCaslin & Hickey, 2001; Schunk, 2001). Using this theory to examine how students may potentially develop and refine regulatory skills is relatively new to educational research (Corno & Mandinach, 2004; Hadwin & Oshige, 2007; McCaslin & Hickey, 2001). However, one of the benefits of using this framework is that it allows researchers to focus their investigations on individual and group level processes simultaneously, thus gaining a new perspective on how students can acquire and refine regulatory abilities (Corno, 2006; McCaslin & Hickey, 2001).

Sociocultural Model

Underlying sociocultural approaches to SRL is the construct of coregulation. From a sociocultural perspective, coregulation describes interactions between two or more peers that coordinate their efforts at planning, monitoring, and evaluating processes (e.g., cognitive, motivational, behavioral, and/or enactment strategies)[1] until the less capable peer is able to self-regulate independently (McCaslin & Hickey, 2001; Yowell & Smylie, 1999). In other words, peers may share in monitoring task engagement, effort, or attention; jointly setting goals and planning strategic approaches to the problem; coordinating multiple goals and ideas; and/or sustaining engagement through positive talk and support (Patrick & Middleton, 2002). These examples of coregulation describe *interpersonal* interactions among peers as they share responsibility for regulating

---

[1] Enactment strategies are overt and covert strategies directed at (1) self-control including cognitive, metacognitive, volitional control, and emotional control strategies and (2) other control strategies such as help seeking and environmental task structuring strategies (McCaslin & Hickey, 2001).

intrapersonal processes, and in which a goal of the coregulation process is to move toward autonomous self-regulated learning (McCaslin & Hickey, 2001).

Reciprocal teaching is an example of an instructional approach based on Vygotskian constructivist theories of regulation (Palinscar & Brown, 1984). In reciprocal teaching, the teacher models comprehension strategies students can use as they read a text. These include strategies such as summarizing, making predictions, and identifying parts of the text that are hard to understand. Students begin to practice aspects of a strategy with the teacher coregulating his or her processes. As students become more competent using the strategies, teacher support fades and eventually these students become models for other students.

In a collaborative context, coregulated learning may take the form of a group member who possesses strong regulatory skills (e.g., leader) working one-on-one with another group member—sharing in regulating planning, monitoring, or evaluating processes. For instance, on a group research project, the student with higher self-regulated learning may support another group member as he/she creates a graphical organizer (e.g., outline) to organize information he or she has gathered related to their topic. Thus, for those peers with less developed behavior, cognitive, and/or motivational regulation strategies, joint work on the collaborative task could create an opportunity to learn strategies from other group members which in turn might develop their own self-regulated learning. That being said, while a goal of coregulated learning is for the individual to eventually move toward autonomous self-regulated learning, it is hypothesized that this process may take time and involve continued experiences working with the MRO in order to develop.

Most, if not all, researchers who investigate coregulated learning agree with McCaslin and Hickey's definition (Patrick & Middleton, 2002; Butler, 2002; Jaavela et al., 2007); however, there are examples in the literature of other forms of coregulation that can potentially occur when students work in collaborative groups. These examples suggest that one group member may not consistently assume the role of MRO on all aspects of the task. Rather, several group members possess strengths at different regulatory processes, some of which are better suited for a particular aspect of the task more so than others. Similar to the idea of socially shared cognition, or co-construction of ideas (Resnick et al., 1991) under these conditions the MRO is not a single individual; rather, this role alternates among group members depending on whose regulatory strategy is best suited for the task. Here, the goal is to move toward success on a given task, and individuals alternate in regulating planning, monitoring, and evaluating activities in order to accomplish their goals. Finally, yet another example of coregulation in collaborative tasks is when two or more group members jointly share in regulating cognition, motivation, and behavior simultaneously.

Thus, I argue that the definition of coregulation should include these other types of regulation that may occur when students work in groups. This expanded definition conceptualizes that coregulation can take on many forms, including the following: (1) a single more capable group member coregulating another, (2) each group member taking on the role of MRO depending on the strengths of a particular learner, or (3) several group members sharing together in regulating the groups' activities. In all instances, an individual or a group of individuals *share(s)* in regulating other individual's regulatory processes. According to McCaslin and Hickey's original definition the responsibility for coregulating rests with one individual who is assumed to possess a greater degree of self-regulated learning strategies and who uses his or her knowledge of how to self-regulate in order to facilitate the development of SRL in a learner. Whereas, in the expanded definition the responsibility for coregulating learning either alternates or is shared among multiple group members.

An examination of several examples from the literature can help to illustrate the different forms of coregulation. For example, Patrick and Middleton (2002) described an instance during a global warming unit in which one group member coregulated her peer’s learning and how this led to his own efforts to self-regulate. During this unit, students worked in groups to explore issues related to colors and heat absorption; that is, sunlight reflects less energy on darker colors thereby absorbing the heat filled rays. At one point, a student asked his group members “why deserts are hotter than rain forests, even though the yellow sand is a lighter color than the green vegetation of rain forests?” (p.32). Each group member proposed a number of hypotheses that might explain this phenomenon including there are no clouds over the desert to reflect the heat, certain minerals found in sand cause more sunlight to be reflected, and there was no greenhouse effect overhead. Marius, who suggested the final hypothesis, offered numerous explanations to support his reasoning. Monitoring Marius’ reasoning, however, another group member coregulated Marius' learning by helping him to realize a misunderstanding in his reasoning—that there is a greenhouse effect around the whole earth so why not the desert. The researchers explained that this caused Marius to re-evaluate his initial assumptions (i.e., a form of self-regulation), and as a result he rejected his own hypothesis.

This example is most consistent with a direct interpretation of McCaslin and Hickey's definition of coregulated learning. Here, before the peer coregulated Marius' learning (i.e., monitoring and evaluating his argument), Marius had not engaged in any actions to self-evaluate his own reasoning. Following the instance, however, Marius assumed responsibility for self-evaluating his argument independently—evidence of self-regulation.

The previous example differs from the next example from Corno (1994), which is more consistent with an expanded definition of coregulation in which *each group member* shares in regulating aspects of the activity. To highlight how regulation is shared among various group members, some interpretations have been added in italics.

Anne: Come on, let's work. You work. *Anne regulates motivation by using goal-oriented group talk; she also is regulating the group member's behavior by focusing their attention to the task*
Paul: Okay, eight times five is…*evidence of self-regulation*
Honey: Five times eight *monitoring of Paul's comment*
Paul: …is forty *Paul regulates Honey by monitoring her calculation*
Paul: it's forty! Its right! Its right! *Paul regulates group motivation through motivating talk*
Anne: Oh, yeah!
Paul: Five times one is five plus four is nine *Paul self-regulates his own thinking*
Sal: gotta round to the nearest ten *Sal monitors Paul's thinking, evaluates his answer, and suggests a modification*
Paul: that too
Sal: Zero times five? What's zero times five?
Anne: how did you get 900 for that? *Questioning as a strategy for monitoring cognition*
Sal: Ten, Zero
Paul: Why did you ask me if you knew? *Paul engages in regulating behavior through environmental structuring. In essence he is reducing distractions so he can continue what he is doing* You don't know how to do nine hundred?
Anne: I don't understand *self-regulating,* Wait a minute *regulating behavior -- time management*. Ms Panagiotoppoulos! I can't understand this. I did all of this. *Regulating behavior by seeking help.*

In this example, group members had opportunities to (1) model and coregulate other group members, (2) practice and refine their own regulatory processes, and (3) externalize a number of strategies that their peers then use to self-regulate. In contrast to the Patrick and Middleton (2002) example in which coregulation was between a more knowledgeable group member and a learner, in this case, regulation was shared among all the group members. Notice how Anne and Sal regulated the other group members' motivation several times throughout the passage using strategies such as goal-oriented and self-efficacy talk. Similarly, all group members shared responsibility for monitoring each other's thinking processes by questioning, making judgments about the accuracy of each other's answers, and offering solutions.

Integrating Social Cognitive and Sociocultural Theories of Regulation

Drawing on social cognitive and sociocultural theories of regulation this research proposes that both theories are helpful in understanding how students develop, use, and refine regulatory processes in a collaborative context. To review, social cognitive theories explore how students learn a number of strategies to regulate their cognition, motivation, and behavior from models, and how their individual characteristics (i.e., cognitive and motivational orientations) affect their use of SRL processes. Sociocultural theories examine if and how a MRO coregulates a learner's strategy use until the learner internalizes these strategies, and he or she is able to self-regulate independently. When individuals use coregulation in a collaborative context, it is hypothesized that several forms of coregulation are present. For instance, coregulation can constitute a single more capable group member coregulating another, each group member taking on the role of MRO depending on the strengths of a particular learner, or several group members sharing together in regulating the groups' activities. While the current literature places different emphasis on the role the social context plays in the development of students' regulatory processes, this research uses social cognitive and sociocultural theories to analyze a learning environment in which it is hypothesized that both self- and social forms of regulation are present.

By integrating these theories of regulation, the present research uses a theoretical framework which proposes that:

1. students possess individual characteristics (i.e., orientations) that affect their SRL.
2. in the collaborative context students will engage in self- and coregulatory processes to regulate cognition, motivation, and behavior.
3. instances of coregulation may potentially lead to increases in self-regulated learning.
4. self-regulation, coregulation, and group performance are measurable predictors and outcomes.

Within Group Processes That Lead to the Development of SRL

Quality of Collaborative Discourse

Collaborative work provides a context for students to practice and develop self- and coregulatory processes when students engage in high quality discourse. Discourse refers to the turn-by-turn exchanges that occur among students in a group (Sawyer & Berson, 2004), and high-quality discourse is necessary for success in collaborative groups (Webb & Palinscar, 1996). High-quality discourse occurs when students explain their ideas and strategies to each other, uphold their own perspectives, ask high-level questions, allow for alternative interpretations and suggestions, evaluate each others' reasoning, modify plans, and in general, reach agreed upon understandings (King, 1999). However, not all forms of questioning and explaining are equally effective at promoting high levels of discourse (Webb, 1992; King, 1999; Chinn, O'Donnell, & Jinks, 2000). For instance, Webb (1992) found that elaborated explanations were most likely to correlate with high levels of discourse and academic performance. When group members use elaborated explanations to describe or justify content-related information and problem-solving strategies it increases or clarifies knowledge or understanding about the task. Importantly, providing elaborated explanations has benefits for both the person doing the explaining and other group members to whom the action is directed, and can lead to increases in achievement (Yackel, Cobb, & Wood, 1991; Webb, 1991; Webb & Farivar, 1994). Finally, high-quality discourse is correlated with complex argumentation around tasks that require deeper analysis of content (Chinn, O'Donnell, & Jinks, 2000). That is, when tasks promote productive, intellectual arguments that encourage analysis, synthesis, elaboration, and reflection, the level of discourse is also of high quality.

To promote high-quality discourse, efforts have been made to design interventions that structure group interactions. These include scripted interactions, specific instructions for the task and group roles, and instruction in various discourse skills. For instance, King (1998) provided peer groups with a set of guiding questions (e.g., What do we know about the problem so far?) from which they chose questions to ask each other. The questions structured the group discourse and promoted high-level questioning and deep analysis of the content. Other methods include scripted cooperation (see Dansereau, 1998) and reciprocal teaching (see Palincsar & Brown, 1984). While research on these programs has suggested benefits to learning and academic achievement, others (Cohen, 1994; Rosenshine & Meister, 1994; Salomon & Globerson, 1989) have argued that these interventions may thwart spontaneous, co-construction of knowledge, and actually constrain the development of higher order thinking skills (King, 1999). According to Cohen (1994), “group interaction must be structured in order to promote the kind of high-level discourse necessary for peer mediation of problem-solving and generative thinking. The structure however needs to be flexible enough to provide students freedom to adapt those discourse skills and patterns to their particular task demands and group needs. Such freedom within structure is a delicate balance in group learning contexts.”

High-level discourse may facilitate the development of self-regulatory processes in collaborative groups in the same way it promotes effective problem-solving processes and the acquisition of new knowledge. When students engage in high-quality discourse, they make thinking and regulatory processes explicit and available to the group (Bargh & Schul, 1980). Externalizing self-regulated learning processes may provide opportunities to monitor or evaluate a particular plan or strategy, making it easier to identify inferior strategies that may need to be abandoned or improved in the future. Furthermore, it may allow for the possibility that the student himself or herself may learn more control over regulatory skills by the very act of making them explicit. High-quality discourse may also allow for the possibility that others may learn new strategies or modify existing regulatory processes as a result of coregulation. For instance, as group members cope with challenging tasks there are opportunities for them to share various planning approaches to solve the problem. The high level of discourse helps to make overt the rationale and benefits for these employed regulatory strategies.

The quality of discourse within a group is strongly influenced by the kind of discourse in which the classroom teacher engages. Webb, Nemer, and Ing (2006) noted that the level of discourse produced by students in a class mirrored that of their teacher. When the teacher engaged in low levels of explanation of concepts or focused on procedural issues rather than conceptual issues, the students imitated that level and kind of discourse.

Modeling

Modeling may provide opportunities for students to acquire, use, and refine SRL strategies in group settings. Research has suggested that by observing models, learners vicariously form expectations about the consequences of certain actions. Individuals are more likely to perform actions in which the model was successful and which they find valuable (Bandura, 1986). This has the potential to result in the learner displaying new behaviors that prior to modeling were unlikely to occur (Bandura, 1986; Schunk, 1987).

The group learning literature has primarily focused on understanding how explicit modeling of learning and problem-solving strategies related to students' acquisition of expert procedures (Collins, Brown, & Newman, 1989; Heller & Hollabaugh, 1992; King, 1992). For example, Heller and Hollabaugh (1992) used modeling to develop problem-solving skills with collaborative groups in an introductory physics class. Group members observed a model, and they analyzed and solved a series of physic problems. Then they were told that they could use these same strategies to solve novel tasks. When students were explicitly told that the modeled information was relevant, they applied previously observed problem-solving strategies to help them solve the problem.

While the majority of research on modeling involves adult models working with young children (Radziszewska & Rogoff, 1988; Schunk, 1981; Zimmerman & Ringle, 1981), some research has suggested peer models can also prove effective. Coping models, for example, display common behavioral deficiencies and share with learners their task-related fears as they verbalize how they solve problems. Through their continued effort and sustained motivation, coping models show how they gradually improve their performance. Mastery models, on the other hand, demonstrate flawless performance (Schunk, 1987). In a study of changes in learners' self-evaluative skills after working with coping and mastery models, researchers found that students in the coping model condition showed the greatest increases in problem-solving processes and self-efficacy beliefs. One implication of extending this work to collaborative learning is that it can provide natural opportunities for students to observe fellow group members regulatory processes, who typify coping models.

Collaborative learning provides a natural opportunity for students to model various self-regulation skills. These opportunities occur when peers observe peers work through and resolve a challenging task or problem, and subsequently attempt to apply this newly learned skill to a novel task. That is, when peers work together and a challenge arises during a problem, students in need of additional support have the chance to observe MROs' work gradually to resolve the task challenge. Specifically, a MRO may model the monitoring of the task, plan for how to readdress the problem, and finally evaluate the newly attempted strategy.

Students can also observe peers' efforts to regulate their motivation on challenging tasks. For instance, a peer may respond to fellow group member's ideas with excitement and interest. Similarly, another group member can point out the features of the task that are related to a personal interest outside of school. These are effective strategies for encouraging participation and increasing motivation in the group. As other group members observe a peer model these regulatory processes, they may begin to communicate using these motivational messages. While this is an example of implicit modeling, there are also instances where the modeling can be more explicit, such as when the modeler suggests to other group members what strategies they can employ to maintain group motivation.

Explaining

Learning in groups may also create opportunities for students to learn self-regulatory processes by explaining and providing accompanying justification for ideas. Providing and receiving explanations may facilitate the development of self-regulatory processes in collaborative groups in the same way it promotes acquisition of new knowledge and problem-solving processes (Webb, 1991; Webb & Farivar, 1994). For instance, as group members cope with challenging tasks there are opportunities for them to share various planning approaches to solve the problem. One student (A) may suggest reading through all the supplementary materials first before approaching the problem, while another student (B) proposes that the group list a couple of goals or concepts to look for as they read in order to narrow their focus. If student B explains that his strategy has benefits such as setting goals that they can later use to monitor progress and check work, he has the potential for increasing the regulation of his group. In addition, if

Student B’s strategy is effective in conjunction with the posed explanation, there is an increased chance that Student A may adopt this planning strategy on future tasks. Similarly, examples of explaining strategies for behavioral regulation are also possible. Group member A may motivate his team to work harder and invest effort. This request for continued high-quality work might be accompanied by an explanation that the task deadline is approaching, and that only through hard work by all members of the group will the task criteria be met. The accompanying explanations help to make overt the rationale and benefits for these employed cognitive and behavioral regulatory strategies. Thus, group members benefit from opportunities to explain and receive explanations about a number of SRL processes because of their participation in the collaborative tasks. As a result, they have the opportunities to modify and learn new SRL strategies.

Instructional Features That Encourage Self- and Coregulated Learning

In this research, students worked collaboratively to design and implement a project in an area related to the group member’s shared interests. Collaborative learning environments may be appropriate environments to examine students’ self-regulated learning and coregulated learning processes (Järvela & Järvenoja, 2007); however, collaborative learning techniques are not always appropriate, and not all groups are always productive (O’Donnell & O’Kelly, 1994). That said, some tasks are more likely to result in productive collaborative learning groups and increased use of SRL processes (Cohen, 1994; Perry, 1998).

According to the individual SRL research, tasks that are complex and personally meaningful can provide natural opportunities for students to apply and develop SRL strategies (Perry, 1998). Although this literature has focused on task characteristics that promote individual SRL, I propose extending these principles to also consider how coregulated learning develops in collaborative group settings. Complex, personally meaningful tasks are particularly well suited to study the social origins of self- and coregulated learning because these tasks require students to work together coordinating multiple cognitive, motivational, behavioral processes to construct various products. Because complex, meaningful tasks require students to use various forms of self- and coregulation in order to execute the task successfully, they create an appropriate context for students to develop and refine these skills, as well as for researchers to investigate these processes in practice.

First, when tasks are complex it is unlikely that one group member will possess all the resources (e.g., information, problem-solving strategies, materials, and so on) to complete the task independently, and instead, group members must rely on each other's expertise for the group to succeed (Cohen, 1994; Cohen & Arechevala-Vargas, 1987). It is important to note that complexity of the task does not necessarily imply an overtly challenging task. Rather it refers to how the task is designed. For instance, does the task address multiple goals, take place over a prolonged period of time, and provide opportunities for students to engage in a variety of metacognitive and cognitive processes, and allow students to showcase their strengths through a range of products (Perry et al., 2004, Wharton-McDonald et al., 1997)? If so, then these tasks will increase an individual's SRL by providing them with sources of feedback on their progress, opportunities to develop, use, and refine a number of cognitive, motivational, behavioral learning strategies (Perry, Phillips, & Dowler, 2004; Bruning, Schraw & Ronning, 1995; McCaslin & Good, 1996; Turner, 1997).

When tasks are complex, group members learn that their success relies on all members assuming responsibility for sharing their planning, monitoring, and evaluative processes (Cohen, 1991) which promotes interdependent reciprocal relationships among group members (Cohen & Arechevala-Vargas, 1987). When tasks emphasize interdependent reciprocal relationships, students learn that the success of the group relies on individuals assuming responsibility for sharing their regulatory processes and helping each other develop these skills (Cohen, 1991). Finally, tasks that are complex usually require more than one class period to complete, thus increasing the number of opportunities group members have to model, support, and develop SR skills. In the present research design, teachers facilitate students as they design complex projects that extend over a nine-week period and are cross-disciplinary. Because of the length of the projects and their complexity, students have multiple opportunities to contribute to the group and display their particular strengths. Projects are designed so that a single student could not complete the project independently.

Second, researchers have found that students are naturally quite skilled at regulating their own learning when tasks are interesting, fun, personally meaningful, and relevant in some way to their personal goals (McCombs & Whisler, 1989; Ridley, 1991). In these situations, group members are so engaged in the activity that they focus attention and use regulatory skills in order to accomplish their goals. In some instances this state has been described as “flow” because of how immersed group members are in the activity (Csikszentmihalyi, 1990; McCombs, 2008). It is argued then, that group members want to find ways to regulate their learning because they find the activity interesting and meaningful to their goals.

In addition to tasks being complex and personally meaningful, the literature on collaborative learning also offered a number of other task features that led to effective group interactions. According to that research, tasks that were (1) ill-structured, (2) based on important, intellectual material, (3) required positive interdependence and individual accountability, and (4) included a set of evaluative criteria to determine successful performance led to more effective collaboration among group members (Lotan, 2003).

First, ill-structured tasks in addition to complex tasks are necessary for effective group interaction (Cohen, 1994). Tasks that are ill structured are typically more effective at promoting high-level cooperation compared to tasks that have one correct answer (Peterson, 1990). These tasks are particularly effective because they encourage co-construction of knowledge, interdependence and interaction, pro-social behavior, and high-level explanations (Peterson, 1990). Lotan (2003) also suggested that tasks leading to effective group interaction required students to use multiple intellectual abilities in order to solve the problem. Such tasks provide a variety of opportunities for students to demonstrate their abilities, talents, and interests and for teachers and peers to witness each other's strengths. The result can be changes to the social system, making it more equitable for everyone (Cohen & Lotan, 1997). In the present research, tasks were ill structured and open ended in that there was no single correct way to proceed or a right or wrong answer. Instead, students were given the freedom to design projects that incorporate the group members' interests.

Next, tasks that require students to be interdependent and include measures of individual accountability are more likely to promote high-level collaborative processes (Cohen, 1994). Tasks that can be accomplished independently are not effective at eliciting the type of interaction and interdependence needed for effective collaboration (Cohen, 1994). In these tasks students simply divide the work and complete the exercise on their own. One method for promoting interdependency is to provide students with only one worksheet or require them to turn in one collaborative group product (Johnson & Johnson, 1990). This technique elicits interdependence by encouraging students to form common goals (i.e., positive goal interdependence), and share individual resources to attain those goals (i.e., resource interdependence) (Johnson & Johnson, 1990). Thus, for groups to function productively, they need to possess *both* high-goal and high-resource interdependence. For example, groups can possess high-goal interdependence by sharing a common goal (e.g., turning in an excellent product) but if they divide the task among group members (i.e., groups are not resource interdependent), effective interaction will not ensue (Cohen, 1994). Alternatively, groups will also not function well if members do not share a common goal and only interact in order to get information from each other. In fact, research by Johnson, Johnson, and Stanne (1990) found that groups who were resource and goal interdependent functioned more effectively (e.g., greater interaction, increased high-level processing) compared to groups who were only resource interdependent (e.g., jigsaw groups) or goal interdependent (e.g., traditional cooperative learning groups). Cooperative learning groups that are only resource interdependent are perhaps the most ineffective type because there is little motivation for higher functioning students to ensure that lower ability students understand the material (Huber & Eppler, 1990).

Finally, Lotan (2003) suggested that tasks with clear evaluative criteria lead to more effective groups. Clear evaluations describe specific criteria teachers provide to students that describe their expectations for a successful product. The criteria should assess a variety of skills and abilities, refer to the curriculum, and point to the connection between the activity and overall goals of the class. Providing students with the evaluative criteria not only grants them a guide to the teacher's expectations, it also gives them a framework to use to evaluate their own work. In the present research, students were given their weekly and final assessment product rubrics at the start of their projects, and each teacher discussed each criterion on which the groups' performance would be measured.

For example, research has found that students in classrooms that support high SRL activities displayed quantitative and qualitative differences in SRL strategies compared to students in classrooms with low SRL activities (Perry, 1998). To start, students in high-SRL environments were more likely to focus on the meaningful, interesting aspects of the task rather than the mechanical processes. These students were also more likely to seek challenging activities as a way to gain personal mastery in the subject matter. Similarly, students in the high-SRL classrooms exhibited a greater number of and better quality SRL strategies, including using organizational tools to plan for their writing in their portfolio, evaluating their work independently, seeking support from peers and teachers when needed, and juggling the steps in the writing process. Furthermore, they made use of a number of environmental structuring strategies such as working on sections of the task in which they had the most information, managing their time around when they could receive support from teachers and peers, and making notes of important things to discuss with peers and teachers in upcoming meetings. Finally, students in the high-SRL group chose peers who shared similar interests and who could help them become better learners. This contrasted with students in the low-SR group who chose partners based on friendship and spent most of the time off task.

In this research, students worked collaboratively to design and implement a project in an area related to the group members' shared interests. The nature of this task included a number of the characteristics suggested by the literature to support the development of, use of, and refinement of SRL strategies. As such, the task was designed so that students' projects were open ended, authentic, complex, and collaborative. As a result, I expected the context to help promote students use of regulatory strategies. Although the research on task features has examined self-regulatory processes, I hypothesized that when these task characteristics were present instances of coregulation should also be evident. While I anticipated that there would be a number of processes that support students’ regulation in the task, three processes (i.e., quality of collaborative discourse, modeling, and explaining) are discussed here because of their prominence in the literature.

Rationale for Mixed-Age and Same-Age Conditions

Piagetian and Vygotskian theories propose alternative hypotheses on group learning (see O’Donnell & O’Kelly, 1994). Specifically, a Piagetian view of peer learning (De Lisi & Golbeck, 1999) would advocate peers of equal status and mutual influence while a Vygotskian approach (Hogan & Tudge, 1999) would advocate more skilled others assisting less skilled others. Research has been gathered that support both hypotheses (see O’Donnell & O’Kelly, 1994). For instance, Kruger (1992) found that peer groups produced higher levels of reasoning and higher quality discourse on a moral reasoning task in contrast to mother-daughter dyads. In contrast, in the Reciprocal

Teaching Technique students have shown to be successful models and are able to scaffold younger students learning effectively (Palinscar & Brown, 1984).

Alternatively, while research supports the claim that even young learners self-regulate (Perry, 1998), it is clear that not all types of regulation are equally effective, and not all learners regulate all the time (Winne, 1995; Perry & Winne, 2006). One possible explanation for this finding is that developmental changes account for differences in students' use of regulatory processes (Zimmerman, 1990). This line of research posits that as individuals grow older, they are better able to (1) differentiate between different strategies, (2) self-assess their abilities and motivational orientations, and (3) monitor their learning (Pressley, Levin, & Ghatala, 1984). However, it is not clear whether age-related changes in SRL explain differences in regulation, or alternatively, that self-report instruments used to measure young children's SRL are appropriate for capturing distinctions in their regulation (Perry & Winne, 2006).

Thus, this dissertation examined peer groups comprised of mixed-age and same-age peers to investigate whether differences exist in the degree to which mixed age and same age peer groups regulated one another's cognition, motivation, and behavior and the types of strategies they use to do so. Both qualitative and quantitative data were used to triangulate findings in order to come to a deeper understanding of the regulation processes group members used to regulate their cognition, motivation, and behavior when working on a complex, collaborative task over nine weeks.

Measuring Regulation

Finally, issues of measurement are important to discussions of SRL because researchers must draw inferences about cognitive operations that they cannot directly observe. As such, issues related to establishing reliable construct validity remain at the forefront of this research.

Measuring Individual Characteristics (i.e., Orientations) of Self-Regulated Learners

Instruments that measure individual characteristics that affect SRL include self-report questionnaires, structured interviews, and teacher judgments. Self-report questionnaires are by far the most widely used instruments to measure the characteristics of students with high SRL. *The Learning and Study Strategies Inventory* (LISS) (Weinstein, Schulte, & Palmer, 1987) and *Motivated Learning Strategies Questionnaire* (MLSQ) (Pintrich, Walter, & Baxter., 2000) measure how students' attitudes, motivational orientation, time management skills, expectancies, values, levels of concentration, and so on correlate with high SRL. While self-report data have added significant knowledge about students' perceptions of their SRL to the literature (Perry & Winne, 2006), a complete reliance on self- report data raises validity issues as to the extent to which students' perceptions reflect actual performance (Winne & Jamiesson-Noel, 2002). Because self-report questionnaires do not take into account the context in which students' responses are framed, interpreting such data may be problematic. Furthermore, self-reports can be inaccurate or incomplete especially with young children who often confuse intention with action. Thus, if the child intends to concentrate or do good work this is often reported as actually concentrating and doing good work. Young children are also generally optimistic and display positive result bias (Turner, 1995). Furthermore, they often struggle with the language, which biases the results of many self-report measures. As such, researchers have established other measures to be used in conjunction with self-report data in order to triangulate research findings.

A structured interview protocol is another measure used to assess individual characteristics associated with high degrees of SRL. Zimmerman and Martinez-Pons' (1988) SRL interview schedule, SRLIS, identifies a number of SRL strategies and ways to identify high- and low-achieving students using this protocol. Similarly, these researchers have also developed a rating instrument for teachers to use to evaluate students' SRL strategies. The constructs in the teacher judgments scale are similar to those measured in the structured interview protocol. Both instruments have been used quite extensively throughout the literature and have high statistical reliability (Perry & Winne, 2006).

Measuring SRL Processes

Conversely, instruments that measure SRL processes include think-aloud activities, methods of error detection in tasks, trace methodology, and measures to observe task execution (Winne & Perry, 2000). In think aloud tasks, a student verbally reports his or her thoughts as he or she completes an activity. This method can be highly effective for measuring SRL processes (Winne & Perry, 2000). When using methods of error detection in tasks, a researcher purposefully enters errors into students' materials to assess if they can detect them and if so, corrective actions they take. Trace methodology is used in computer-supported programs to record signs or observable indicators of students' cognitive processes as they perform tasks (Winne & Perry, 2000). In other words, the computer program will collect detailed information about which tools students use as they navigate through the site and explore different functions of the program. Finally, measures to observe task execution involve detailed observations of children as they complete an activity while keeping a structured record of their self-regulated processes. These methods are particularly effective because they provide evidence of what the child is actually doing that can be tied to the context in which it was performed (Perry, 1998). Videotaping is a particularly effective observational technique because it stores verbatim conversations of students engaging in self-regulating activities. Furthermore, the researcher is able to compare and contrast different SR processes over time without having to rely on the accuracy of his or her memory (Winne & Perry, 2000). As such, most researchers consider observational methods more objective than self-reports and often pair them with interviews to gather students' reactions to the researcher's observations (Winne & Perry, 2000).

Measuring Coregulated Learning Processes

To measure forms of coregulation requires analyses aimed at capturing group regulation processes (Arvaja, Salovaara, Hakkinen, & Jarvela, 2007). Group level processes describe the collaborative processes group members use to coregulate each other as they work on a task. To capture this kind of data requires an understanding of students' conversations and the tools they use to support their learning (Hmelo-Silver, 2003). Recall that social theories of SRL posit that regulation takes place within a context, and as such, researchers cannot examine learning without taking into account the context in which it occurred. Here, context refers to students' patterns of interaction and common tools (Arvaja et al., 2007).

While research methodology in this area is limited, Arvaja et al. (2007) has borrowed from process analysis to develop a method for measuring how students coregulate a task. To analyze coregulated processes in the group, one conducts a qualitative content analysis of the major themes, noting the particular context in which they occur. For example, the researcher not only codes for instances of planning, but also describes the context in which planning occurred. Then he or she analyzes the discourse to examine the communicative functions of individuals' coregulated speech. Finally, one codes the contextual resources students use to help coregulate their learning.

To analyze individuals' reactions to the collaborative activity, self-report questionnaires are distributed at specific points throughout the task. These data are analyzed to determine individuals' perceptions of their coregulation in order to make inferences about how group members coregulate the task. More importantly, this information serves as a method of triangulating the qualitative data, providing the researchers with a way to examine individuals' perceptions within the learning situation that were not "observable" in the qualitative analysis. Thus, self-report data serve to complement and triangulate the qualitative date of group members' coregulation processes (Arvaja et al., 2007). Thus, by embedding research in context, using mixed methodology, and triangulating the data, this method espouses a holistic description of the coregulated processes used in a task (Miles & Huberman, 1994).

To summarize, this research investigated how collaborative group work served as an appropriate context in which to examine the development, use, and refinement of self- and coregulated learning, and the effect different types of grouping had on regulatory processes. To frame this research I have (1) reviewed social cognitive and sociocultural theories of SRL, (2) proposed that collaborative learning environments may be an appropriate context in which to study multiple forms of regulation, (3) discussed the literature on tasks that encourage students to self-regulate, and (4) examined data collection techniques researchers have used to investigate self-regulated and coregulated processes using various methodological techniques. In the next section I present my research questions and methodology.

Statement of Research Questions

This dissertation examined self-regulation and coregulation processes students use as they work in groups to design and implement an authentic, real world, collaborative project based on their shared interests. Specifically, the research addressed the following questions:

1. Does same-age or mixed-age grouping predict students' reports of their time 3 SRL, after controlling for prior SRL?
2. Do motivational orientations, prior SRL, coregulation, final group assessment, and/or features of the intervention predict post-test scores of individuals' reports of SRL?
3. In a purposeful sample of four groups, what self- and coregulated processes do students use to regulate aspects of their cognition, motivation, and behavior?
4. For the groups analyzed in question 3, how consistent are students' reports of their self-regulated and coregulated processes with their observed regulation processes?

CHAPTER THREE

METHODOLOGY

Participants

Participants included 48 sixth grade students and 16 eighth grade students from a large urban K-8 school in northern New Jersey. The school caters to students that have been identified as gifted and talented based on their scores on the TerraNova or NJASK exam. Both exams assess students' knowledge and skills in mathematics and language arts; however, the TerraNova is a national exam administered in grades 1 and 2 in this district, and the NJASK is a state exam administered to students in grades 3 through 8. The goal is for all students to score at or above the proficient level. Students can apply to the gifted and talented program after 1st, 3rd, or 6th grade.

Results of the 2005-06 NJASK indicated that in this population 100% of 6th grade students were at or above the proficient level in both language arts and mathematics, while 95% and 91% of 8th grade students scored at or above the proficient level in language arts and mathematics. This is compared to the NJ state average in language arts and mathematics of 86% and 82% for 6th grade students, and 80% and 64% for 8th grade students. The racial and ethnic composition of the school reflected the larger diversity of the district in that 64% of students were Hispanic, 25% of students were African American, 10% of students were Caucasian, and 2% were Asian. 77% of students were eligible for a free or reduced price lunch program, which is consistent with the district average. The state average, however, is 27%. Information regarding students' socioeconomic status is useful in that it is one indicator of students' access to cultural and social capital—both of which schools and society value (Seiler & Butler, 2005).

The Group Context

Students worked collaboratively to design and carry out a project with students who share similar interests. Teachers acted as facilitators to help students focus their areas of interest, formulate a plan, model appropriate information seeking strategies, and assess their projects. Ultimately, however, the responsibility for a successful project lied with the students. The openness of the task, which afforded students the opportunity to select a topic and plan how to solve it, the authenticity of this task, and its long-term duration created an appropriate context to investigate how peers can potentially facilitate self- and coregulatory skill development. Because students were allowed to investigate topics that were of interest to them, group projects had the potential to be inherently interesting and meaningful to students. When students were provided with opportunities to explore topics that were interesting and important to them, it was likely that they would be motivated to participate and engage in their projects (Patrick & Middleton, 2002). This context also created opportunities for students to exert choice and control during their projects, which may have led them to initiate and develop purposeful cognitive and metacognitive engagement (Patrick & Middleton, 2002). Finally, these tasks required that students employ regulatory skills in order to manage their projects successfully (Perry, 1998). In order for students to be able to work collaboratively with others and explain or justify their ideas, they had to plan, monitor, and evaluate their ideas and actions. Furthermore, group members had to work together to set goals, design and carry out processes that are directed toward those goals, and monitor and evaluate their progress toward achieving their goals (Perry et al., 2004). Ideally then, these contexts created a variety of opportunities for students to regulate their learning, and for me to investigate these processes (Patrick & Middleton, 2002).

For example, one group interested in learning about dinosaurs researched various dinosaurs in the late Jurassic period in order to design a new wing for the Museum of Natural History. To gain a real-world perspective, the group contacted Donna Sethi, Director of Education for the Museum of Natural History, who provided them with information on the process researchers, scientists, and interior designers use to design a new wing. Students also used diagrams from the museum's website as well as information about the size of NYC blocks to calculate the dimensions of their new wing. Next, to determine the most efficient and logical layout design for their new wing, students grouped dinosaurs by geographic region. Last, the group used ratios to make a scaled model of their new wing, along with educational activities to help visitors learn more about Jurassic era dinosaurs. As this example illustrates, this project required students to employ a number of individual and social forms of regulation to successfully navigate interactions with peers and to produce a successful project.

Conditions

To be equitable to all students, the school requested that I include all 6th grade students in the research design so I was not able to have a control group. However, I was able to include some 8th grade students (to be part of mixed age groups) in the study to test for age-related differences between same age and mixed age groups as a supplemental hypothesis. The purpose of this was to investigate Piagetian and Vygotskian theories which propose alternative hypotheses on group learning (see O'Donnell & O'Kelly, 1994). Specifically, a Piagetian view of peer learning (De Lisi &

Golbeck, 1999) would include peers of equal status and mutual influence, while a Vygotskian approach (Hogan & Tudge, 1999) would include more skilled others assisting less skilled others. Moreover, I was given the flexibility to randomly assign students to condition, classroom, and group, which is quite rare in classroom-based research because of scheduling issues. As such, students were assigned randomly to one of two classes of same-age peer and one of two classes of mixed-age peer groups. In each class there were four groups of students, and classes met for 45 minutes a day, five days a week. Students were grouped by their interests in mathematics, language arts, science, performing arts, or writing in order to ensure they would be able to agree on a common topic. These groupings were based on a questionnaire students took at the end of the previous year.

Measures

Students completed a number of self-report surveys at various points throughout the project to assess their perceptions of regulation, the task, and their motivational orientations. Table 3.0 provides the data collection timeline for this study.

Table 3.0

Data Collection Timeline

Time	Surveys
Time 1: Pre-test	Self-Regulated Learning, Motivational Orientation
Time 2: Week 6	Coregulated Learning, Task Features
Time 3: Post test	Self-Regulated Learning

Surveys included the *Self-Regulated Learning Questionnaire*, the *Coregulated Learning Questionnaire*, the *Motivational Orientation Survey*, and the *Task Features Survey*. These measures were adapted from existing measures in the literature and are described in detail below.

Self-regulated learning questionnaire. This sixteen-item survey included five subscales to assess the degree to which students regulate their cognition, motivation, and behavior when writing a research report (see Appendix A). Items from this survey were adopted with permission from five SRL scales in the literature (Schwarzer et al., 1999; Howard et al., 2000; Wolters et al., 2005; Martinez-Pons, 1999; Linnenbrink, 2005). Schwarzer and colleagues' (1999) *Self-Regulation Scale* measured how students regulated their attention and emotion in an activity (α = .76). In contrast, Howard et al.'s (2000) survey included items related to the metacognitive strategies students used to solve problems (α = .81). The survey developed by Wolters and his colleagues (2005) measured students' strategies for regulating their cognition, motivation, and behavior (α =.74 to .85). Finally, Martinez-Pons's (1999) *Five Components Scale of Self-Regulation* measured the degree to which students regulated motivation, goal setting, strategy use, and self-evaluation (α = .70 to .90).

These surveys were chosen because of their pervasiveness, internal reliability scores, and use in middle school populations. Items from each survey were combined to form this SRL questionnaire, because no individual survey included measures of cognitive, motivational, and behavioral regulation. Because of the initial diversity of the survey items, the statements were rewritten to refer to a common activity. On the SRL time 1 survey, this activity was working on a research report. This activity was chosen because it required the same types of skills students used in this project (e.g., planning, managing information, integrating, analyzing, and so on). On the SRL time 3 survey, the items referred to working on this project.

The subscales included in this questionnaire were goal planning (e.g., "Before I work on my research report, I set goals to guide what steps I will take"), monitoring (e.g., "As I work on my research report, I ask myself questions to make sure I understand what I am doing"), strategy use (e.g., "As I work on my research report, I make charts, diagrams, pictures"), self-evaluation (e.g., "As I work on my research report, I double check to make sure I am doing it right"), and effort regulation (e.g., "I work hard to do well on my research report even if I don't like writing reports") (see Appendix A). Students responded to statements based on a four-point scale where the number indicates the degree to which the student believed he or she did what the item described. Choices included always (4), most of the time (3), some of the time (2), or never (1).

Coregulated learning questionnaire. The *Coregulated Learning Questionnaire* contained 24 items and was intended to measure the same constructs as the *Self-Regulated Learning Questionnaire.* However, the *Coregulated Learning Questionnaire* asked students to respond to items that measured their coregulation processes instead of their individual regulation processes. For example, statements such as, "Before I work on my research report, I set goals to guide what steps I will take" was restated as "Before we started working on our project, our group set goals to guide what steps we would take" (see Appendix B). The subscales included in this questionnaire were goal planning (e.g., "Before we work on our projects, we set goals to guide what steps we will take"), monitoring (e.g., "We made sure everyone understood before we moved on to the next part of our project"), evaluation (e.g., "In our group we checked each other's work to make sure each other's research is correct"), attention (e.g., "If someone in our group became distracted we were able to refocus everyone's attention back on our project"), and effort regulation (e.g., "We worked hard on our project even if we didn't like all the parts") (see Appendix B). Students responded to statements based on a four-point scale where the number indicated the degree to which their group did what the item described. Choices included always (4), most of the time (3), some of the time (2), or never (1).

Motivational orientation survey. This eighteen- item survey was adapted with permission from several established survey measures (Ryan, 1983; Midgley, Maehr, Hruda, Anderman, Anderman, Freeman, Green, Kaplan, Kumar, Middleton, Nelson, Roeser, & Urdan, 2000; Wolters et al., 2005; Pajares, 2007). Ryan's (1983) *Prosocial Self-regulation Questionnaire* measures the reasons why children engage in various pro-social behaviors (alphas range from .62 to .82). *PALS* scales (Midgley et al., 2000) include measures of students' academic self-efficacy (α =.78), academic self-handicapping (α = .84), and perceptions of novelty (α = .78). Wolters and his colleagues' (2005) survey assesses students' strategies for relevance enhancement (α = .80) while Pajares' (2007) *Goal Orientation Scale* measures students' self-efficacy for self-regulation. These surveys were chosen for their pervasiveness in the literature and with middle school students. I selected items from multiple instruments to create an overall measure of students' motivational orientations that relate to SRL (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Yamauchi & Tanaka, 1998; Krapp, 1999).

This survey included subscales related to general academic self-efficacy (e.g., "I believe I can accomplish anything taught in my classes"), avoiding novelty (e.g., "I prefer to do class work as I have always done it, rather than trying something new"), relevance enhancement (e.g., "I try to connect the material I learn in class with something I like doing or find interesting"), and goal orientations (e.g., "I want to do better than other students in my class") (see Appendix C). Students responded to statements based on a four-point scale where the number indicated the degree to which the student believed he or she did what the item described. Choices included always (4), most of the time (3), some of the time (2), or never (1).

Task features survey. This twenty-item survey was adapted from the *Post-Experimental Intrinsic Motivation Inventory* (Ryan, 1983), which measures students' interest/enjoyment (α = .78), perceived competence (α = .80), effort (α = .84), pressure/tension (α = .68), perceived choice, value/usefulness, and relatedness to other group members in the task. Statements were reworded to refer to students' projects. This survey asked students about how interesting the task was (e.g., "I enjoy working on our project"), how much effort they put into their projects (e.g., "I put a lot of effort into our project"), whether they perceived they had choice/ autonomy in their projects (e.g., "I believe I had some choice about doing our project"), whether their projects were optimally challenging (e.g., I believe our project was too hard to complete), if they perceived that their projects had some value (e.g., "I think our project is an important activity"), and whether they perceived that their group had positive group cohesion (e.g., "I feel everyone in the group played an important role on our project") (see Appendix D). Students rated the degree to which they agreed/disagreed with the statements on a four-point scale. Higher numbers indicated higher forms of agreement.

Group final project assessment rubric. This assessment served as the performance measure of the groups' final projects. Each teacher scored this rubric during the final poster presentation of all group projects. This allowed teachers to view all sixteen groups' projects before they assessed the projects of the four groups in their own class. The final project assessment rubric had eight categories that were each evaluated on a three-point scale. The eight categories were creativity, accuracy of content, relevance of graphics, organization, knowledge, skills, attractiveness, and mechanics (see Appendix E). For example, to earn a score of three on creativity the project idea and products students made had to be exceptionally creative. If either the project idea or the products were not creative, then students were given a score of two. Finally if neither the project idea nor the products reflected creativity, then students were given a score of one in this category.

Positive Response Bias

To deter students from overestimating their SRL, motivation, coregulated learning, and perceptions of task features while completing these surveys several steps were taken. First, the same set of directions was read each time a survey was given and students had the opportunity to ask questions at anytime throughout the administration. Second, students were told that their answers would not likely match other students' answers and that this was normal. Third, each question and its answer choices were read aloud. Fourth, students were reminded that their answers would not affect their grade, that I would be the only person to see their surveys, and that their answers would be coded to ensure confidentiality. Finally, to ensure that students understood what each item meant, I piloted a subsample of each survey with a group of 6th and 8th grade students and then asked them to interpret each question and why they chose a particular answer. If a large number of students misunderstood a particular item, this item was reworded to eliminate any confusing language.

Procedure

Consent forms were distributed in January 2008, and teachers collected them during regularly scheduled classes. Only students who obtained parental consent were eligible to participate in this study. During the first week of the study, students completed the *Self-Regulation Questionnaire* and the *Motivational Orientation Survey*. The order in which each survey was administered was counterbalanced in order to avoid any order effects. Sixth grade participants without scheduling conflicts and who obtained parental consent were randomly assigned to either the same-age (N = 48) or mixed-age (N = 16) peer condition. Eighth grade students were randomly assigned to the mixed-age condition. There were two 6th grade students and two 8th grade students in each mixed age group, and four 6th grade students in each same age group. There were two classes of same-age peer groups and two classes of mixed-age peer groups that met for 45 minutes each day over nine weeks. Four teachers participated in the study, and each was randomly assigned to either a mixed-age or peer-age class. Finally, students in both conditions were randomly assigned to groups based on shared interest in mathematics, science, history, or literacy. During the first week of group activities, all students participated in a series of daily team building exercises to build cohesion and interdependence among group members before they began to design their projects (Cohen, 1994).

Preparing students to work in small groups. Research suggested that putting students into groups does not simply guarantee that they will work effectively together (Webb & Weishaupt, 1998). Instead, students need opportunities to get to know each other and feel more comfortable interacting with their fellow group members before they are asked to work on academic tasks. Students work in groups most effectively when the group work is sequenced and structured into four stages: class-building activities, learning how to work with each other, refining communication and cooperation skills, and learning help seeking skills (Webb & Weishaupt, 1998). Students in this research project participated in three team building activities before beginning their actual projects. First, students participated in an ice-breaker game in order to help students familiarize themselves with their classmates (day 1, Tuesday, February 5, 2008). Students were placed in pairs and asked to stand back to back with each and interlace their arms. Their goal was to be able to sit down and stand back up without separating their shoulders. After students completed the task they were asked to come to the board and write a strategy they used to complete the task. Examples included communication, using a resource, having a plan, etc. As a class we then discussed tools that students used/ could use to effectively communicate with each other during group work, and what kinds of communication reflected a cooperative social environment. The next day, students were assigned to their groups. In their groups, students participated in the Tower Activity (days 2 & 3). For this activity, each group was given one piece of construction paper and a piece of scotch tape measuring one foot long. Their goal was to construct the tallest tower possible using all of their materials. Before students began using the materials, they had to develop and write down a plan for how they would construct their tower. They also had to indentify three strategies for working cooperatively from the previous day's discussion and use these when interacting with their group members. This activity was intended to help students' practice team building and small group social skills strategies. Finally, students spent the fourth day of group building activities choosing a group name that everyone agreed on.

During week 2, students constructed a group collaborative collage. This exercise was intended to help students identify their shared interests as a group (see Appendix F). This led to the identification of one or two themes that group members agreed that they would like to base their projects on. At the end of the week, groups presented their collaborative collage to the class.

At the beginning of week 3, each group received a group binder. In each binder were a number of supporting materials to structure the development of students' group projects. These materials were given to students in their group binder so that they would have a place to store all information related to their projects. Students were free to organize the information in their binder as they deemed appropriate. To help group members broaden their theme(s) into a complex project, students used the "I have a theme, now what" and "Project Description" worksheets (see Appendix G and H). These materials were intended to (1) act as a scaffold to help group members brainstorm and elaborate on their shared themes, (2) ensure that group members could describe their projects in narrative form, (3) help students identify their learning goals for their project, and (4) serve as a record of their long term plans. Also included in their binders were a number of materials intended to help group members manage their projects. These consisted of knowledge webs and research pages. Knowledge webs acted as a brainstorming and organization tool to help students manage their projects. Each product circled on the "I have a theme, now what" worksheet became a separate knowledge web (see Appendix I). For example, in the soccer group one of their product ideas that they identified on their "I have a theme, now what" worksheet was to learn more about different product materials and staff personnel. As such, "learn more about materials" became its own knowledge web in which students brainstormed anything they would need to know more about, research, or decide on in order to purchase materials (see Appendix I). For instance, students would need to know more about cleats, shin guards, goalie gloves, and soccer balls. Finally, for each item identified in a knowledge web, students used a research page to record information they found that related to that item (see Appendix J). Thus, information related to goalie gloves was recorded on a separate research page from research related to different kinds of cleats. The last item included in students' binders was a calendar section. This contained daily, weekly, and monthly calendars that students could use to help organize and manage their projects (see Appendices K and L).

To guide students through this process, I developed a sample project based on building a log cabin in upstate New York. Using this as a model, students and I discussed how information from the "I have a theme, now what?" worksheet was transferred to a knowledge web, and eventually became the information that they researched and recorded on their research pages. As a class, students brainstormed potential strategies they could use to find information and what to do when they encountered obstacles. Finally, participating in this exercise gave students the opportunity to practice using these materials before they were asked to use them to develop their own projects.

During the remaining weeks, under the direction of a teacher facilitator, groups designed independent projects in an area that was deemed to be of high interest. All groups were videotaped during these sessions. One camera was positioned at the head of each group's table to capture processes they use to regulate. The researcher also collected students' binders which included various artifacts, lists of group goals, task completion timetables, notes, and other work that was used as evidence of their regulation. Students completed the *Coregulated Learning Questionnaire* and the *Task Features Questionnaire* during week 6 and the *Self-Regulated Learning Questionnaire* once again during the final week of the project. Finally, teachers evaluated their students' group projects using the *Final Project Assessment Form* during the school-wide poster session during the final week of the project. Table 3.1 provides a summary of the procedures followed in this study.

Table 3.1

Timeline of Procedures

Week Number	Activity
1	Team-building exercises, *Self-regulated Learning Survey*, *Motivational* Orientations *Survey*
2	Collaborative collages
3	Introduction to binder and model presentation, students begin "I have a theme, Now what" worksheet on Wednesday February 20, 2008
4	Knowledge webs, Research
5	Knowledge webs, Research
6	*Coregulated Learning Survey*, *Task Features Survey*
7	Continue working on project
8	Easter Break
9	PowerPoint Presentations, Final Assessment Rubric, *Self-regulated Learning Survey*

Quantitative and Qualitative Analytic Procedures

Quantitative Analysis Procedures

Among the different quantitative analyses were factor analysis, reliability analysis, and hierarchical linear modeling. Next I provide a brief discussion of the relevant characteristics of each quantitative analysis procedure I used.

Factor analysis. Factor analysis is a statistical procedure used to explain the variability in a relatively large number of observed variables in terms of a smaller number of unobserved "factor" variables. In this sense, factor analysis is used as a data reduction technique where the observed variables are modeled as linear combinations of the factors and the relationships among observed variables are used to reduce the dataset. I also used factor analysis as a construct validity tool. Kerlinger (1986) writes, "It may be called a constitutive meaning method, since it enables the researcher to study the constitutive meanings of constructs—and thus their construct validity" (p. 590). Specifically, I used principle component analysis to compute the best linear combination of the variables in the *Task Features Survey*. The result of this analysis (i.e., a factor coefficient matrix) was used to construct factor scores and to confirm the construct validity of the underlying constructs I intended to measure in this survey. In the regression paradigm, the variance of the factor scores is equivalent to the squared multiple correlation between the estimated factor values and the real factor scores (Norusis, 2007). Thus, for the purposes of this study factor analysis was used to (1) confirm the underlying constructs in the *Task Features Survey* and (2) to use factor analysis results to compute composite scores based on the factor loadings to be used in the HLM analysis.

Reliability analysis. The purpose of a reliability analysis is to measure the stability or internal consistency of results. In general it provides an estimate as to how consistently participants perform either over time, format, or on items or subtests within a test. For the purposes of this research, I was concerned with the latter; that is, if participants performed consistently on a subset of items within a survey. If this were so, it would connote item homogeneity, which would be an indication that I could have some confidence those participants would answer similarly to other possible items within the same content domain. Specifically, I used Cronbach's alpha as a measure of how well a set of items measured an underlying construct. In general, when Cronbach's alpha was high (greater than .8; Kline, 1998), this was interpreted as evidence that the items in a particular survey all measured the same underlying construct (e.g., self-regulated learning). Thus, for the purposes of this study, Cronbach's alpha was used to justify using all the items to form a composite score for each survey. Given the small sample size and that the factor structure differed by time period, this was considered a conservative approach to forming a composite score.

Hierarchical linear modeling (HLM). HLM (Raudenbush & Bryk, 2002) is a statistical technique used to analyze data that have a nested or hierarchical structure. For example, data could have students nested in classrooms, or students nested in groups that are nested in classrooms. Because of the multilevel structure of the data, it is important that the variance in an outcome variable is analyzed at multiple hierarchical levels. In general, HLM is a more sophisticated version of simple linear regression or multiple linear regression in that it attempts to model the relationships between one or more predictor variables and an outcome variable. In this particular study, I used HLM to separate the individual student level variation from the group level variation in self-regulated learning. By using HLM, I was able to model both individual level and group level characteristics within a single model. As such, I was able to account for both individual and group level effects simultaneously, which resulted in a more comprehensive understanding of the relationship among variables that predict self-regulated learning.

Qualitative Data Analysis

Purposeful sampling. Of the sixteen groups videotaped in this study, four groups were chosen to illustrate various regulatory patterns in greater depth. The method used to choose the four groups was theory-based purposeful sampling. *Theory-based* or *operational construct* sampling is the process of selecting "incidents, slices of life, time periods, people or groups on the basis of their potential manifestation or representation of important theoretical constructs" (Patton, 2002, p. 238). The purpose of using a theory-based sampling method was to develop an in-depth understanding of the aspects of a particular construct across a wide variety of settings and conditions (Glaser and Strauss, 1967). Because it was my goal to examine how group members self- and coregulate aspects of their cognition, motivation, and behavior, I purposely chose three groups that had successful end products to see if successful groups used different regulatory patterns. The fourth group was an unsuccessful group. This group was chosen to see if successful/ unsuccessful groups used different or similar regulatory patterns. The four groups chosen were the car, soccer, dinosaur, and fashion group. The car group consisted of four high-achieving students who demonstrated competence in a number of self-regulated learning processes. This group received a 24 out of 24 possible points on the final product assessment rubric. The second group, the soccer group, was also successful on their group project, earning 23 out of 24 possible points on their final product assessment rubric. During data collection I observed that one group member, Henry, appeared to be instrumental to the group's success and was often observed regulating his fellow group members. Thus, I became interested in learning how group processes for groups that included a highly self-regulated individual corresponded to or differed from other groups. This is why I selected the soccer group. The dinosaur group was the third group chosen for the qualitative analysis. This group also received a 24 out of 24 possible points on their final product assessment rubric. However, it appeared during data collection that this group coregulated the majority of their cognitive, motivational, and behavioral processes, even though this group included four relatively average self-regulated learners. Finally, I chose the fashion group to examine self- and coregulatory processes in a group who had lower performance on their overall end product. This allowed me to compare and contrast how high-functioning and low-functioning groups regulated their cognition, motivation, and behavior over the course of their projects. It is important to note that all groups engaged in a number of regulatory processes over the course of their projects and I do not intend to imply that group members relied solely on one type of regulation. Three of these groups were chosen because they were all successful and I was interested in how different regulatory patterns may all lead to a successful end product. Because the research is focused on concept development it was appropriate to choose groups that might typify various forms of regulation.

Processing of data. I loaded the video tapes into Microsoft Movie Maker in order to create DVD’s to view the selected footage. This resulted in approximately 120 days of video footage across the four groups to analyze. Each DVD held four to five days' worth of video or approximately 160 minutes of tape. Each DVD became one transcript. In total, I coded data for twenty-five transcripts. Because I did not have the resources to transcribe all verbal instances, it was necessary to separate on-task from off-task behavior. While I only transcribed instances of on-task behavior, the time students spent off task was noted in order to include in the analysis. While I began qualitative analysis with a particular methodological framework in mind, I remained open to new codes and ways to categorize the data.

I began by constructing summaries of each group's conversations and behavior for every fifteen minutes of tape, which I defined as an episode. Discourse within an episode that reflected on-task behavior was transcribed verbatim along with descriptions of students' nonverbal behavior. The data were entered into Nvivo, a qualitative software program, for coding and analysis. Nvivo was particularly helpful in organizing, cross referencing, and synthesizing the data. I developed a coding scheme based on individual theories of self-regulated learning offered by Wolters, Pintrich, and Karabenick, 2005 and Corno, 1994 and extended these examples to propose how regulation might appear within a group setting (see Appendix M). The data were coded according to this coding scheme identifying both instances of regulating cognition, motivation, and behavior, as well as the type of regulation students engaged in (self-regulated or coregulated). Another researcher coded 20% of the transcripts ($N = 5$) in order to establish reliability, which we determined was 88%, and after discussion we agreed on all codes.

Once the data were coded, I compiled in one document instances of regulating cognition, motivation, and behavior for each group in order to identify themes across the codes and to make connections across themes and data sources. These instances were divided into self- and coregulating learning interactions. When identifying themes I searched through the data for negative instances of potential patterns or alternative explanations that could help me to interpret the data. Next, I constructed narratives to provide descriptive summaries of the processes each group used to regulate across data sources and how these skills developed within the group context. Also within this document, I counted the number of instances of each type of regulation and noted whether it was self- or coregulated. Once a document was compiled for all four groups, I compared each of these documents in order to construct an overall summary document that discussed differences in regulatory processes among groups. Because the context of students' regulation (i.e., the time period) may help to understand differences in regulatory processes, I divided the six-week total project period into three time periods. Each time period (that is Time 1, Time 2, and Time 3) refers to the first, second, and third, two-week period of the project, respectively. This was only used as a measure in the count data to see if different regulatory processes were more pronounced during a specific time period within the project.

Standards of quality and verification. Because of the nature of qualitative research analysis, at times what is noted in the data is a reflection of how it is viewed, decoded, and interpreted (Creswell, 1998). In order to avoid any potential bias, triangulation and clarifying researcher bias were used as verification methods in this study. First, data from the transcripts were used along with information from groups' binders and students' responses to survey items as corroborating evidence. The purpose of this procedure was to compare information from one source with data derived from another to "shed light on a theme or perspective” (Creswell, 1998, p. 202). The second procedure used to verify data interpretation was to clarify my role as the researcher. I served as a teacher’s assistant and at times the teacher during this project. In this role, I designed the supporting materials used to help guide students through their research projects, facilitated group discussions, and helped students find information related to their projects. As a researcher and a teaching assistant I undeniably formed relationships with students and teachers in the classroom. It is often the case that “interacting with the world being studied can produce particular effects on the researcher as well as on the participants in the study” (Grieshaber, 2001, p. 144). While I attempted to genuinely collect participant-generated data, students’ decisions to participate, discuss, or respond within the project may have been the result of my position and/or the relationships I developed with each of the participants. Although unavoidable, recognizing the role I might have played in the classroom is important to the integrity of the work.

CHAPTER FOUR

RESULTS AND PRELIMINARY DISCUSSION FOR THE QUANTITATIVE DATA

Students self-report questionnaires along with their final group project assessment rubric scores were used to address research questions 1 and 2. To review, these research questions ask: (1) Does participation in same or mixed aged groups predict students' reports of their SRL at the end of the project, after controlling for prior SRL? (2) Do motivational orientations, prior SRL, coregulation, final project assessment, and/or features of the intervention predict post-test scores of individuals' reports of SRL? Using students' self-report responses and their final project assessment rubric scores, I examined the relationships among students' reports of their (1) self-regulated learning processes, (2) coregulation processes, (3) motivational orientations, and (4) perceptions of task characteristics during the project.

Analytic Strategies

Survey Data

In order to provide a systematic account of the procedures I used to answer each research question, this chapter is organized into several sections. First, I provide general descriptive data of the participants' demographics and responses to each survey. This includes students' age, grade, and gender, as well as the sample size, mean, and standard deviation for each item on each survey. In the next section I provide a description of the data reduction process I used to form composite scores for each predictor and the outcome variable, along with descriptive statistics of these variables for the different subgroups. Finally, to address research questions 1 and 2, I used HLM analysis to investigate the relationships among SRL, condition, coregulation, motivation, and perceptions of task features taking into account that these data were embedded at multiple levels of analysis.

I began data analysis by creating separate SPSS 15 files for each of the following surveys in Table 4.0:

Table 4.0

Distribution of Surveys by Time

Survey	Time 1 (T1, Week 1)	Time 2 (T2, Week 6)	Time 3 (T3, Week 9)
Motivation Orientation Survey	X		
Self-Regulated Learning Survey	X		X
Coregulated Learning Survey		X	
Task Features Survey		X	

Each student was assigned an identification number, and the different files were matched by these numbers. Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS; SPSS Inc., 1999), and Hierarchical Linear Modeling Program (HLM 6.02; Scientific Software International, http://www.ssicentral.com).

Student Demographics

Table 4.1 presents the distribution of participants by gender and grade. There were slightly more 8th grade males than females, though this trend was not present in the sixth grade sample. There were also more 6th grade students in the sample than 8th grade students.

Table 4.1

Distribution of Participants by Gender and Grade Level

Gender	Grade		Total
	Sixth	Eighth	
Male	26	9	35
Female	22	7	29
Total	48	16	64

Table 4.2 summarizes the descriptive statistics for the *Motivation Orientation Survey.* The mean for each item ranged from 2.00 to 3.25. The construct the item was intended to measure is indicated in parentheses.

Table 4.2

Summary Statistics for *Motivation Orientation Survey*

Item	Mean	Std. Deviation
Accomplish anything taught in class (self-efficacy)	3.25	.62
Class work that is new (novelty)	2.00	.89
Better than others (goal orientation)	2.09	.90
Able to do my class work (self-efficacy)	2.95	.60
Like class work that I learn even if I look stupid (goal orientation)	2.83	.85

I do not prefer to do class work as always done it (novelty)	2.31	.77
Connect material to something I like (relevance)	2.53	.94
Class work learn from even I make lots of mistakes (goal orientation)	2.61	.87
Class work makes me think (goal orientation)	2.48	.93
Able to do class work even with distractions (self-efficacy)	2.91	.75
Even if the work is hard, I can learn it (self-efficacy)	3.16	.76
Like new work, rather than familiar work (novelty)	2.00	.76
Make work useful by relating it to life (relevance)	2.45	.89
Work hard on difficult class work b/c I'm learning (goal orientation)	2.95	.68
Will choose class I haven't done (novelty)	2.03	.80
Effort to relate class work to interests (relevance)	2.63	.86
Do class work b/c I like to learn (goal orientation)	2.63	.83
Do class work b/c I am interested in it (relevance)	2.30	.92

Table 4.3 presents the descriptive data for the *Self-Regulated Learning Survey* at time 1 and time 3. With the exception of Items 1 and 8, on average, students' SRL increased

over the course of the project. The average time 1 responses ranged from 2.21 to 3.4 while the average time 3 responses ranged from 2.6 to 3.5. Again, the construct the item was intended to measure is indicated in parentheses.

Table 4.3

Summary Statistics for *Self-Regulated Learning Survey* Time 1, Time 3

Item	Mean Time 1	Std. Deviation Time 1	Mean Time 3	Std. Deviation Time 3
1_read all plans carefully (planning)	3.17	.63	2.95	.77
2_work long time without distraction (regulating attention)	2.38	1.00	2.97	.76
3_even if I am bored I won't quit (effort regulation)	2.88	.79	3.52	.67
4_planned (planning)	2.22	.93	3.09	.75
5_read plans for that day (planning)	2.25	.96	2.88	.92
6_ask questions to make sure I understand what I am doing (monitor)	2.47	.78	2.64	.84
7_use info from other	2.34	1.07	2.63	.97

classes (strategy)				
8_double-check work (evaluation)	3.06	.81	2.75	.82
9_work hard even if I dislike some parts (effort regulation)	3.41	.79	3.50	.69
10_not difficult to stick to planned schedule (planning)	2.39	.90	3.14	.71
11_set goals that are realistic (planning)	2.63	.81	2.98	.93
12_pay attention to what I am doing (monitoring)	3.14	.81	3.30	.68
13_do not give up quickly when no answer (effort regulation)	3.14	.83	3.47	.71
14_pace so not rushing (regulating time)	2.78	.83	2.89	.74
15_set goals that are manageable (planning)	2.98	.92	3.08	.86
16_make charts, diagrams, pictures (strategy-use)	2.06	.77	2.45	1.08

The descriptive data for the *Coregulation Survey* given at time 2 are presented in Table 4.4. The average score on each item ranged from 2.25 to 3.68.

Table 4.4

Summary Statistics for *Coregulated Learning Survey*

Item	Mean Time 2	Std. Deviation Time 2
1_we read our plan carefully before beginning work	3.23	.68
2_we look over each other's work/ know what others are doing	2.73	.82
3_use more than one resource to research	3.13	.85
4_check each other's work to make sure it's correct	2.72	.88
5_able to work on project without being distracted	2.77	.77
6_even when we are bored we finish work	3.25	.80
7_we leave enough time to plan for tomorrow	3.34	.74
8_before working we read over plans for day	3.31	.89
9_make sure everyone understands before moving on	2.80	.72

10_we use information from other classes in our project	2.25	.87
11_we double-check each other to make sure we are correct	2.67	.74
12_if distracted, we help each other refocus	2.61	.83
13_we work hard even if we don't like all the parts	3.17	.70
14_stick to our planned schedule for working on project	3.27	.76
15_when planning, we talk about if they are realistic	2.52	.87
16_in our group we pay attention to what each other is doing	3.13	.79
17_we use other resources besides Wikipedia	3.69	.59
18_we do not do other things besides working on our project	2.98	.79
19_we do not give up quickly when we can't find info we need	3.58	.69
20_we manage time efficiently/ not rushing around	2.91	.73
21_number of plans set for the day is manageable	3.00	.85

22_one group member knows what the other is doing	3.33	.82
23_we use charts, diagrams, pictures to help us organize	2.41	1.06
24_we do not think about other things that get in the way of working	2.94	.69

Finally, Table 4.5 summarizes the descriptive statistics for the *Task Features Survey* given at Time 2. The item's mean scores ranged from 2.67 to 3.52.

Table 4.5

Summary Statistics for *Task Features Survey*

Item	Mean	Std. Deviation
T2_1_Our project is interesting to learn about (interest)	3.18	.55
T2_2_work hard at our project (effort)	3.14	.53
T2_3_Put a lot of effort into our project (effort)	3.04	.67
T2_4_had some choice about our project (autonomy)	3.20	.62
T2_5_our project is useful outside of school (value)	2.87	.72
T2_6_everyone had an important part in project (cohesion)	3.10	.85

T2_7_enjoy working on our project (interest)	3.51	.59
T2_8_project was too hard (R) (optimal challenge)	3.10	.81
T2_9_try hard to do well on our project (effort)	3.21	.65
T2_10_had a role in choosing our project (autonomy)	3.15	.80
T2_11_could really depend on people in my group (cohesion)	2.87	.80
T2_12_interested in our project (interest)	3.43	.53
T2_13_was able to complete our project on time (optimal challenge)	2.78	.98
T2_14_I worked hard on our project (effort)	3.25	.66
T2_15_feel like I had a choice in our project topic (autonomy)	3.15	.83
T2_16_our project is an important activity (value)	3.01	.80
T2_17_group really worked as a team (cohesion)	3.07	.59
T2_18_think project was boring (R) (interest)	3.39	.55

T2_19_did not do all the work myself/ I had help from group members (cohesion)	3.40	.63
T2_20_feel like the students in my group listen to each other (cohesion)	2.98	.78

Data Reduction

Overview

Four instruments were used to measure participants' motivation, self-regulation, coregulation, and perceptions of the task features over the course of this project. Taken together, these surveys included over seventy items that amounted to a large number of variables given the relatively small sample size of this study. As a result, it was necessary to perform data reduction techniques to generate composite scores to reduce the risk of inflating type I error. Two techniques, reliability analysis and principal components analysis, were employed for this purpose. I used Kline's (1998) index of .8 or greater to indicate a sufficient value of Cronbach's alpha for this purpose.

Reduction of the Self-Regulated Learning Variables

Cronbach's alpha is an appropriate statistic to measure how well a set of items (or variables) measure a single unidimensional latent construct (www.ats.ucla.edu/stat/sas/notes2). As such, this statistic was used to determine whether the sixteen items used in the *Self-Regulated Learning Survey* all measured self-regulation for the purposes of combining the items to form a single composite score for the HLM analysis. I followed Kline's (1998) recommendation for alpha values greater than .8 to indicate high reliability.

Table 4.6

Self-Regulated Learning Survey (Times 1, 3): Cronbach's Alpha if That Item Is Deleted

Item	Cronbach's Alpha Item Deleted SRL Time 1	Cronbach's Alpha Item Deleted SRL Time 3
1_read all plans carefully (planning)	.76	.84
2_work long time without distraction (regulating attention)	.76	.86
3_even if bored I do not quit (effort regulation)	.75	.86
4_planned (planning)	.77	.85
5_read plans for that day (planning)	.78	.84
6_ask questions to make sure I understand what I am doing (monitoring)	.77	.84
7_use info from other classes (strategy)	.80	.86
8_double-check work (evaluation)	.76	.85
9_work hard even if dislike some parts (effort regulation)	.78	.85
10_not difficult to stick to planned schedule (planning)	.78	.85
11_set goals that are realistic (planning)	.76	.85
12_pay attention to what I am doing	.76	.85

(monitoring)		
13_do not give up quickly when no answer (effort regulation)	.76	.87
14_pace so not rushing (regulating time)	.76	.86
15_set goals that are manageable (planning)	.76	.85
16_make charts, diagrams, pictures (strategy-use)	.77	.85

As Table 4.6 indicates, if item 7 were deleted, the reliability would be high enough to satisfy Kline's (1998) criterion. Therefore, I formed a composite score for time 1 and time 3 surveys that consisted of all items except item seven. The mean for the SRL Time 1 composite score was 2.73 with a standard deviation of .43, whereas the mean for the SRL Time 3 composite score was 3.04 with a standard deviation of .47. The SRL Time 1 composite score will be used as a predictor variable in the HLM analysis, whereas the composite score for SRL Time 3 will be used as the outcome variable.

Reduction of the Coregulated Learning Variables

A similar process was used to calculate composite scores for students' responses to the *Coregulated Learning Survey*. Table 4.7 illustrates Cronbach's alpha for each item if that item was deleted from the analysis.

Table 4.7

Coregulated Learning Survey: Cronbach's Alpha if That Item Is Deleted

Item	Cronbach's Alpha Item Deleted
1_we read our plan carefully before begin work	.84
2_we look over each other's work/ know what others are doing	.84
3_use more than one resource to research	.84
4_check each other's work to make sure its correct	.83
5_able to work on project without being distracted	.84
6_even if we become bored we finish work	.84
7_we leave enough time to plan for tomorrow	.84
8_before working, we read over plans for day	.83
9_make sure everyone understands before moving on	.83
10_we use information from other classes in our project	.84
11_we double-check each other to make sure we are correct	.84
12_if distracted we help each other refocus	.83
13_we work hard even if don't like all the parts	.83

14_stick to our planned schedule for working on project	.83
15_when planning, we talk about if they are realistic	.84
16_in our group, we pay attention to what each other is doing	.83
17_we use other resources besides Wikipedia	.84
18_we do not do other things besides working on our project	.85
19_we do not give up quickly when we can't find information we need	.84
20_we manage time efficiently/ not rushing around	.83
21_number of plans set for the day is manageable	.83
22_one group member knows what the other is doing	.84
23_we use charts, diagrams, pictures, to help us organize	.84
24_we do not think about other things that get in the way of working	.85

Since the reliability was greater than .80 with all items included I did not eliminate any items when forming the composite score for the *Coregulated Learning Survey*. The mean for the composite coregulated learning scores was 2.99 with a standard deviation of .39.

Once a composite score consisting of students' answers to all the questions on the *Coregulated Learning Survey* was formed, the mean for each group was calculated. The mean score for each group became a predictor variable in the HLM analysis.

Reduction of Motivation Orientations Variables

Similarly, Cronbach's alpha was also used as a measure of item homogeneity in the *Motivation Orientation Survey*. This statistic equaled .804, which exceeded Kline's (1998) recommendation of acceptable reliability. Scores on this survey were combined to form a single composite score for motivation. This variable was used as a predictor variable in the HLM analysis.

Reduction of the Task Features Variables

This survey measured students' perceptions of the task features, including: autonomy, effort, optimal challenge, interest, value, and group cohesion (refer to the Methods Section for a description of items that were associated with each construct). Originally, Cronbach's alpha was used as a measure of item homogeneity in this survey and it was .71. Because reliability was relatively low according to Kline's criterion, I reviewed the items on the *Task Features Survey* again. After rereading the items I determined that the items may not all measure the same underlying construct, and this may explain the relatively low reliability.

To investigate this further, I used Principal Components Analysis with Varimax Rotation to reduce the number of predictors to a smaller set of factors. This principal components analysis was first run using the default option of retaining all factors with eigenvalues (i.e., a measure of variance) greater than 1.0 (Gorsuch, 1983). This process yielded six factors which accounted for 68.94% of the total variance (see Table 4.8).

Table 4.8

Factor Matrix for *Task Features Survey*

Item	Component					
	1	2	3	4	5	6
T2_11_can really depend on members of my group (cohesion)	.77					
T2_6_everyone played an important part in project (cohesion)	.73					
T2_17_group really works as a team (cohesion)	.72					
T2_20_feel like the students in my group listen to each other (cohesion)	.68					
T2_9_try hard to do well on our project (effort)		.79				
T2_3_Put a lot of effort into our project (effort)		.75				
T2_14_I work hard on our project (effort)		.73				
T2_2_work hard at our project (effort)		.51				
T2_12_interested in our project (interest)			.80			
T2_18_do not think project was boring (interest)			.76			.33
T2_1_Our project is interesting to learn about (interest)			.67		.32	
T2_7_enjoyed working on our project (interest)	.37		.65			
T2_15_feel like I had a choice in our project topic (autonomy)				.81		

T2_10_played a role in choosing our project (autonomy)				.81		
T2_4_had some choice about our project (autonomy)				.57	.48	
T2_5_our project is useful outside of school (value)					.81	
T2_16_our project is an important activity (value)		.36			.71	
T2_8_project was challenging but not too hard (optimal challenge)						.84
T2_13_able to complete our project on time (optimal challenge)						.70
T2_19_do not all the work myself, have help from group members (cohesion)	.36				.41	.43

Factor 1 contained items 12, 6, 18, and 20 which all related to participants' sense of their group cohesion. This factor had a mean of 3.01 and a standard deviation of .61. Cronbach's alpha for factor one was .82. Items 9, 3, 14, and 2 loaded on factor 2 was defined as students' perceived effort on their projects. Factor 2 had a mean of 3.48 and a standard deviation of .41. In addition, Cronbach's alpha for factor 2 was .75. Next, items 12, 18, 1, and 7 loaded to form factor 3, which related to students' interest in their projects. This factor's mean was 3.16, and it had a standard deviation of .49. Furthermore, Cronbach's alpha for factor 3 was .79. Factor 4, which was defined as autonomy, was comprised of items 15, 10, and 4 with a mean score of 3.17 and a standard deviation of .61. Factor 4 had a Cronbach's alpha of .82. Items 5 and 16 loaded together to form factor 5 which related to the perceived value of the task. Factor 5 had a mean of 2.95 and a standard deviation of .69. Cronbach's alpha for factor 5 was .73. Finally, 8, 13, and 19 were defined as factor 6, which related to whether students felt the task was optimally challenging. Because item 19 loaded significantly on more than two factors, it was removed from the analysis due to difficulties with interpretation. The mean of factor 6 was 2.95, and the standard deviation was.76. Cronbach's alpha for factor 6 was .70.

While the six factors were consistent with the variables I intended to measure a priori, the relatively small sample size limited using all six factors as predictors in the HLM analysis. That being said, it would also be inappropriate to form one composite score that included all the variables measured on the *Task Features Survey* because of the overall low reliability. To alleviate this problem, I used the literature to guide my understanding of which constructs measure task features. As a result, I decided to form a composite score that included interest, value, autonomy, and optimal challenge variables to be used in the HLM analysis. These variables were combined because they all have to do with perceptions of the *task*, whereas cohesion and effort do not. Cronbach's alpha for these variables was .86 which met Kline's (1998) minimum acceptable standard for reliability. Using a composite score of these variables as a predictor in the HLM analysis was the best way to manage sample size limitations and also act in a way that was consistent with previous theoretical findings.

Summary of Reduction of Variables

To summarize: to form composite scores for the *Self-Regulated Learning*, *Coregulated Learning,* and *Motivational Orientations* surveys, I used reliability analysis to establish that the items in the survey measured the same underlying construct. I then computed a composite score for each of these surveys to also be used in the HLM analysis. The composite scores for the *Self-Regulated Learning Survey* (Time 1), the *Coregulated Learning Survey*, and the *Motivational Orientations Survey* serve as predictor variables, and the composite score for the *Self-regulated Learning Survey* (Time 3) serves as the outcome variable. In contrast, I used factor analysis to reduce the number of items on the task survey to six factors that accounted for 68.94% of the total variance. A composite score was calculated using the interest, value, autonomy, and optimal challenge variables. This score serves as predictor variable in the HLM analysis.

Hierarchical Linear Modeling (HLM) Analysis

I used Hierarchical Linear Modeling (HLM; Raudenbush & Bryk, 2002, also known as multilevel modeling, Kreft & De Leeuw, 1998) as the primary statistical procedure for this study because of the data's nested (i.e., hierarchical or clustered) structure. When data have a hierarchical structure, the statistical analysis must account for the nested structure in order to avoid inflating type I error (Kreft & De Leeuw, 1998; Pedhazur, 1997; Raudenbush & Bryk, 2002; Stevens, 2002). HLM is particularly suited for nested data since it allows for the examination of group level effects on individual outcomes. As a result, I was able to investigate the relationships between constructs that are embedded at multiple levels of analysis (Snijders & Bosker, 1999). The sample size in this study was relatively small for HLM analysis; therefore, it was necessary to keep the number of predictor variables low in each model that I ran. The higher the number of predictor variables, the greater the chance the model would not converge and the estimates would be unreliable (Raudenbush & Bryk, 2002). The software program HLM6

(Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2004) was used to carry out the HLM analysis, and the final solution was estimated using restricted maximum likelihood (Raudenbush & Bryk, 2002; Raudenbush et al., 2004). Table 4.9 provides a summary of Power Analysis for this particular sample size based on Optimal Design Version 1.76 (Spybrook, Raudenbush, Liu, Congdon, & Martinez, 2008).

Table 4.9.

Summary of Power Analysis for n = 4; j = 16 Sample Size

Intra-class Correlation (ρ)	Effect Size (δ)	Power (if as in this case n = 4, and j = 16)	J (if power = .80, n = 4)
.05	.20	.11	226
	.50	.41	38
	.80	.80	16
.10	.20	.10	256
	.50	.38	44
	.80	.74	18
.15	.20	.10	286
	.50	.34	48
	.80	.69	20

As shown in Column 3, relating to the current scenario (i.e., n = 4, j = 16), if the effect size is large (i.e., δ = .80), then the study can achieve power of .80, .74, and .69, with intra-class correlations of .05, 10, and .15, respectively. In contrast, the power of the study was not sufficient to detect small and medium effect sizes with this sample size, regardless of the magnitude of intra-class correlations. Column 4 shows the number of groups needed to achieve a power coefficient of .80 for three effect sizes and three intra-class correlations. According to this analysis, then, there was adequate power for HLM to detect a large effect size between the two treatments with this number of groups and group size. Furthermore, because pretest scores were available, and their use as a covariate can considerably increase power in experimental designs, I included prior SRL in this study (Hedges & Hedberg, 2007).

Level 1 and Level 2 Variables

HLM analyzes nested data by modeling level 1 (individual-level) and level 2 (group-level) variables simultaneously. The purpose of the level 1 model is to investigate the relationships among individual variables, that is, variables that are associated with individual persons. A dependent outcome variable is also included at level 1. This results in intercept and slope parameters that are conceptually similar to results derived from OLS regression (Raudenbush & Bryk, 2002). These level 1 parameters then become the outcome variables in the level 2 model. For the purposes of this paper, individual students formed the first level (level 1) and groups of students working on a single collaborative project formed the second level (level 2). As such, I refer to the level 1 model as the "within group" model and level 2 as the "between group" model.

Ordinary Least Squares (OLS) Regression versus HLM analysis

In their text, Kreft and de Leeuw (1998) have examined a number of procedures statisticians have used to interpret nested data in ordinary least squares regression (OLS). A review of each of these techniques is beyond the scope of this review; however, the authors' general conclusion is that OLS regression fails to model nested data appropriately for several reasons. First, when using OLS regression it is necessary to carry out the analysis at either the individual (i.e., level 1) or group (i.e., level 2) level. When nested data are modeled exclusively at the individual level, each individual (level 1) unit is assigned the same group level (level 2) value. This results in violating the independence assumption because when group values are assigned to individuals, the error terms now have a systematic component (derived from the group level effects) and a random component (Kreft & de Leeuw, 1998). Furthermore, when the same group score is assigned to multiple individuals, standard errors are underestimated and there is a chance of inflating Type I error (Kreft & de Leeuw, 1998). Second, when nested data are modeled in OLS regression at only the group (level 2) level of analysis, it is necessary to aggregate the independent and dependent variables. When level 1 variables are aggregated to level 2, by using the average score for each unit, the variance at level 1 cannot be estimated, which obscures any potential multi-level effects (Kreft & de Leeuw, 1998).

HLM Models

The first research question asked, "Does participation in same or mixed aged groups predict students' reports of their SRL at the end of the project, after controlling for prior SRL?" while research question two asked, "Does motivational orientations, prior SRL, coregulation, final project assessment, and/or features of the intervention predict post-test scores of individuals' reports of SRL?" In order to address these questions, I ran three HLM models.

The Null Model

The first estimated HLM model is called the "null" model because it contains no predictor variables. Essentially, the null model is a one way mixed (i.e., fixed and random) effects analysis of variance (Raudenbush & Bryk, 2002). This model partitions the variance into level 1 (individual-level) and level 2 (group-level) segments (Raudenbush & Bryk, 2002). In this study, the level 1 equation in the null model was

$$\text{SRLT3}_{ij} = \beta_{0j} + e_{ij}\,, \qquad (1)$$

where SRLT3 was the SRLT3 scores for the i^{th} student in the j^{th} group and β_{0j} was the intercept for the j^{th} group. Here, the intercept was equal to the average SRL value at time 3. In the between-group model the parameter of the within-group model (β_{0j}) became the dependent variable at level 2. As such, the level 2 model is

$$\beta_{0j} = \gamma_{00} + \mu_{0j}, \qquad (2)$$

where β_{0j} was the intercept for the jth group and $\gamma_{00,}$ was the between-group intercept parameter. The μ parameter was the residual that represent the unexplained portion of the between-group variance. The results of the null model are presented in Table 4.10.

Table 4.10

Summary Statistics for Null Model

	Coefficient	Standard Error	T-ratio	Approximate DF	*p*-value
Fixed Effect					
Intercept 1, β_0	3.04	.07	41.42	15	0.00*
Intercept 2, γ_{00}					
	Standard Deviation	Variance	Approximate DF	Chi-square	*p*-value
Random Effect					
Intercept1, U_o	.22	.04	15	31.02	0.00*
Level 1, R	.42	.18			

*$p < .05$

As evidenced in Table 4.10, the amount of variation in self-regulated learning between groups was significant ($\gamma_{00} = 3.04$, $t(15) = 41.42$, $p < .05$). More importantly the null model is used to compute the intra-class correlation for the dependent variable, SRLT3. The intra-class correlation is a measure of the degree of similarity between individuals belonging to the same group and is expressed as the proportion of variance at each level that is explained by the random effects (Raudenbush & Bryk, 2002). When the intra-class correlation is high there is a greater chance of violating the assumption of independence as a result of nesting among the observations (Stevens, 2002). This results in an increase in Type I error rate if the statistical analysis does not deal appropriately with the nesting variable (Stevens, 2002).

In this analysis 18% of the variance in self-regulated learning was within groups, and 4% was between groups. Using the equation recommended by Raudenbush and Bryk (2002, p. 71) for computing intra-class correlation, I determined that .18 was the intra-class correlation in this study. Finally, because the group level variance was significant, $X^2(15) = 31.02$, $p < .05$, it was appropriate to move forward with a multilevel analysis (Raudenbush & Bryk, 2002). This means that there was variance at the group level that can still account for differences in the outcome variable.

Model One

Research question 1 (i.e., Does participation in same or mixed age groups predict students' reports of their SRL at the end of the project, after controlling for prior SRL?) was analyzed by adding SRLT1 as a predictor variable at level 1 and Condition as a level 2 predictor. The within-group model (level 1) is a linear regression of SRL time 3 on the centered SRL time 1 scores. I centered both level 1 and level 2 predictors in order to increase the interpretability of the results.

Centering. Centering is used in HLM to (1) produce estimates that are easier to interpret, so that the statistical results have practical validity and (2) eliminate high correlations between the random parameters (i.e., intercepts and slopes), and high correlations between lower- and higher level predictors (i.e., multicollinearity) (Kreft and de Leeuw, 1998). There are two types of centering: group mean and grand mean centering. When a predictor is group mean centered, each group's mean for a particular variable is calculated and then subtracted from each individual's score on that variable. In contrast, when a predictor is grand mean centered, the grand mean is calculated based on all participants' scores, and then this value is subtracted from each of the individual scores. At level 1 the researcher can either group mean or grand mean center depending on the research questions, whereas at level 2 it is appropriate to grand mean center all predictors (Raudenbush & Bryk, 2002). When a variable is group mean centered the intercept (β_0) equals the average outcome variable, in this case average SRL at time 3 (refer to Kreft & De Leeuw, 1998; Pedhazur, 1997; Raudenbush & Bryk, 2002, for more detail on centering). Generally in the social sciences the null hypothesis tests whether the intercept is equal to zero (default without centering). Setting the intercept to zero is not always meaningful; e.g., What does it mean to have “0” SRL? Centering the predicted variables, however, results in a meaningful interpretation of the parameters (i.e., they are now averages). In this model, I group mean centered SRL Time 1 at level 1 and I grand mean centered the dummy coded variable, Condition (e.g., Same age = 0; Mixed age = 1), at level 2. The final within-group (level 1) model was:

$$\text{SRLT3}_{ij} = \beta_{0j} + \beta_{1\text{j}}(\text{average SRL T1})_{ij} + e_{ij,} \tag{3}$$

where SRLT3 was the SRLT3 score for the i^{th} student in the j^{th} group, β_{0j} was the intercept for the j^{th} group, $\beta_{1\text{j}}$ was the slope of the regression for SRLT3 scores on centered SRLT1 scores for the i^{th} student in the j^{th} group, and e_{ij} was the residual error term for the i^{th} student in the j^{th} group.

In the between-group model the parameters of the within-group model (β_{0j}, β_{1j}) became dependent variables at level 2. This model contained the variable, Condition, which referred to whether students were in the same age group or mixed-age group condition. The condition variable was grand mean centered by subtracting the grand mean for condition (i.e., .5) from all values of that variable (Kreft & De Leeuw, 1998; Pedhazur, 1997; Raudenbush & Bryk, 2002). The final between-group model was

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{average condition})_j + \mu_{0j}, \tag{4}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{average condition})_j + \mu_{1j}, \tag{5}$$

where β_{0j} was the intercept for the *j*th group. β_{1j} was the slope for the *j*th group from the within-group model. The between-group intercept parameters (i.e., γ_{00} and γ_{10}) were the average within-group intercept and average within-group slope, respectively, as a result of centering the condition variable. γ_{01} and γ_{11} were the slope coefficients associated with the between-group variable. The μ parameters were residuals that represent the unexplained portion of the between-group variance. To reiterate, the purpose of this analysis was to address research question number 1, that is, to determine whether group condition predicted students' reports of their time 3 SRL, after controlling for prior SRL. The results of this model are displayed in Table 4.11.

Table 4.11

Summary Statistics for Model 1

	Coefficient	Standard Error	*T*-ratio	DF	*p*-value
Fixed Effects					
For Intercept1, β_0					
Intercept, γ_{00}	3.04	.07	39.51	14	.00*
Condition, γ_{01}	-.11	.15	-.74	14	.47
For the slope, β_1					
Intercept, γ_{10}	.25	.11	2.27	60	.03*
Condition, γ_{11}	-.52	.27	-1.93	60	.06
	Standard Deviation	**Variance**	**DF**	X^2	***p*-value**
Random Effect					
Intercept1, U_o	.23	.05	14	33.27	.00*
Level-1, R	.40	.16			

**p* < .05

The results suggested that students' condition (i.e., same, mixed age) was not a significant predictor of SRL time 3 scores after controlling for prior level SRLT1 scores, γ_{01} = -.11, $t(14) = -.74$, $p > .05$. Because I group mean centered, the intercept (γ_{00} =3.04) represented average SRL at time 3. Furthermore, γ_{10}, which was significant, γ_{10} = .25, $t(60)= 2.27$, $p < .05$ represented the average SRLT1-SRLT3 slope. This suggested that for every one unit increase in SRLT1, there was a corresponding .25 increase in SRLT3. The between group variance was significant, $X^2(14) = 33.27$; $p < .05$, so it was appropriate to continue multilevel modeling. To summarize, because the condition variable was not significant, I failed to reject the null hypothesis that there were no difference in SRLT3 scores between same-age and mixed-age groups.

Model Two

Research question 2 asks, Do motivational orientations, prior SRL, coregulation, final project assessment, and/or features of the intervention predict post-test scores of individuals' reports of SRL? A two-level HLM analysis was used to investigate this research question. The final within-group (level 1) model was:

$$\text{SRLT3}_{ij} = \beta_{0j} + \beta_{1j}(\text{av. motivation})_{ij} + \beta_{2j}(\text{av. SRLT1})_{ij} + \beta_{3j}(\text{av. task})_{ij} + e_{ij}. \quad (6)$$

where SRLT3 was the SRLT3 score for the i^{th} student in the j^{th} group; β_{0j} was the intercept for the j^{th} group; $\beta_{1j}, \beta_{2j}, \beta_{3j}$ were the slopes of the regression for SRLT3 scores on centered motivation, SRLT1, and task scores, respectively, for the i^{th} student in the j^{th} group; and e_{ij} was the residual error term for i^{th} student in the j^{th} group.

In the between-group model the parameters of the within-group model (β_{0j}, β_{1j} β_{2j}, β_{3j}) became the dependent variables at level 2. This model also contained the coregulated learning scores and final assessment scores as level 2 predictors. These are group level variables that referred to each group's perceived use of regulation strategies (referred to as CRL) during the project, and the grade each group received by their teacher on their final assessment rubric. These variables were grand mean centered by subtracting the grand mean for each variable from all values of that variable (Kreft & De Leeuw, 1998; Pedhazur, 1997; Raudenbush & Bryk, 2002). The final between-group model was:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{average final assessment})_j + \gamma_{01}(\text{average CRL})_j + \mu_{0j}, \tag{7}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{average final assessment})_j + \gamma_{12}(\text{average CRL})_j + \mu_{1j}, \tag{8}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}(\text{average final assessment})_j + \gamma_{22}(\text{average CRL})_j + \mu_{2j}, \tag{9}$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}(\text{average final assessment})_j + \gamma_{32}(\text{average CRL})_j + \mu_{3j}, \tag{10}$$

where β_{0j} was the intercept for the *j*th group. β_{1j}, β_{2j}, and β_{3j}, were the slopes of each variable presented in the within-group (i.e., level 1) model for the *j*th group. The between-group intercept parameters (i.e., γ_{00}, γ_{10}, γ_{20}, γ_{30}) were the average within-group intercepts. γ_{01}, γ_{11}, γ_{21}, γ_{31} were the slope coefficients associated with average final assessment, while γ_{01}, γ_{12}, γ_{22}, γ_{32} were the slope coefficients related to average coregulated learning scores. The μ parameters were residuals that represent the unexplained portion of the between-group variance. Table 4.12 displays the fixed effects results for this model.

Table 4.12

Summary Statistics for Model 2

Fixed Effects	Coefficient	Standard Error	*T*-ratio	D.F.	*p*-value
For Intercept, β_0					
Intercept, γ_{00}	3.04	.04	75.47	13	.00*
Average Final Assessment, γ_{01}	.04	.01	3.15	13	.00*
Average CRL, γ_{02}	.54	.19	2.76	13	.02*
For Av. Motivation slope, β_1					
Intercept, γ_{10}	.38	.12	3.13	52	.00*
Average Final Assessment, γ_{11}	-.05	.03	-1.71	52	.09
Average CRL, γ_{12}	2.29	.78	2.93	52	.00*
For Av. SRLT1 slope, β_2					
Intercept, γ_{20}	.46	.13	3.36	52	.00*
Average Final Assessment, γ_{21}	-.04	.03	-1.19	52	.23
Average CRL, γ_{22}	1.22	.78	2.53	52	.01*
For Av. Task slope, β_3					
Intercept, γ_{30}	.28	.13	2.04	52	.04*
Average Final Assessment, γ_{31}	.08	.06	1.36	52	.17
Average CRL, γ_{32}	-1.05	.69	-1.52	52	.13

*$p < .05$

For intercept $B_{0.}$ The intercept, γ_{00} was significant γ_{00} = 3.04, $t(13) = 75.47$, $p <$ .05, which indicated that the average SRLT3 score was significantly different from zero. The average final assessment score, γ_{01}, was also significant, $\gamma_{01} = .04$, $t(13) = 3.15$, $p <$ .05, which suggested that groups with higher final assessment grades were also more likely to have high SRLT3 scores. Similarly, the average coregulated learning score, γ_{02}, was significant, which suggested that groups with higher coregulated learning scores were also more likely to have higher SRLT3 scores.

For average motivation slope, $\beta_{1.}$ There was a significant positive relationship between motivation and average SRLT3 scores, $\gamma_{20} = .38$, $t(52) = 3.13$, $p < .05$, indicating that increases in motivation corresponded to a .38 change in average SRLT3, holding SRLT1 and perceptions of features of the task constant. Average final assessment, γ_{11} was not significant, which suggested that the relationship between motivation and SRLT3 was not different for groups with higher/lower final assessment rubric scores. Alternatively, $\gamma_{12,}$ which represented average CRL, was significant, $\gamma_{12} = 2.29$, $t(52) = 2.93$, $p < .05$. This indicated that the relationship between motivation and SRLT3 was stronger for groups with higher self-reported coregulation scores.

For average SRLT1 slope, $\beta_{2.}$ There was a significant positive relationship between SRLT1 scores and average SRLT3 scores, $\gamma_{20} = .46$, $t(52) = 3.36$, $p < .05$. This suggested that a one-unit change in SRLT1 led to a .46 increase in average SRLT3 when holding motivation and features of the task constant. The Average Final Assessment variable, γ_{21}, was not significant, indicating that the relationship between SRLT1 and SRLT3 was not different for groups with higher/lower final assessment rubric scores. Finally, the average CRL variable, γ_{22}, was significant, $\gamma_{22} = 1.22$, $t(52) = 2.53$, $p < .05$, suggesting that the relationship between SRLT1 and SRLT3 was stronger for groups with higher self-reported coregulation scores.

For average task slope, β_3. Finally, there was a significant positive relationship between students' perceptions of features of the task and average SRLT3 scores, γ_{30} = .28, $t(52) = 2.04$, $p < .05$. Thus, a one-unit change in students' perceptions of task features corresponded to a .28 increase in average SRLT3 scores. The slopes, γ_{31} and γ_{31}, which related to final assessment scores and CRL, respectively, were not significant. This suggested that the relationship between average SRLT3 and students' perceptions of task features was not stronger for groups with higher final assessment rubric scores or higher self-reported coregulation scores.

Coregulated Learning and Achievement

In this study, achievement was measured by the group level variable, final assessment rubric score. Because this was a level 2 variable, it could not serve as a level 1 outcome variable. As such, within HLM it was not possible to predict final assessment scores from students' coregulated learning scores. However, because both variables were group level variables, I was able to run an OLS regression model to investigate whether students' coregulated learning scores predicted their final assessment project rubric scores. The regression equation for this model was

$$\textit{Final Assessment} = \beta_0 + \beta_1(\text{CRL}) + e \qquad (11)$$

where *Final Assessment* was the outcome variable, β_0 was the intercept, β_1 was the slope of the regression for *Final Assessment* scores on CRL scores, and e was the residual error. The results for this analysis are presented in Table 4.13.

Table 4.13

Summary Statistics for Regression Model

Model	Coefficient		T	p-value
	B	Std. Error		
Coregulated learning	8.71	3.56	2.45	.02*

*$p < .05$

Coregulated learning significantly predicted final assessment scores, $\beta = 8.71$, $t(14) = 2.45$, $p < .05$. CRL also explained a significant proportion of variance in final assessment scores, $R^2 = .29$.

Summary Discussion of Quantitative Results

The purpose of the quantitative results section was to address research questions 1 and 2, mainly (1) Does participation in same or mixed aged groups predict students' reports of their SRL at the end of the project, after controlling for prior SRL? and (2) Does motivational orientations, prior SRL, coregulation, final project assessment, and/or features of the intervention predict post-test scores of individuals' reports of SRL? Several findings have resulted from the analyses in this section. I will briefly discuss each finding adding preliminary interpretations of the findings where appropriate.

Hierarchical Linear Modeling (HLM; Raudenbush & Bryk, 2002, also known as multilevel modeling, Kreft & De Leeuw, 1998) was the primary statistical procedure used for this study because of the data's nested (i.e., hierarchical or clustered) structure. When data have a hierarchical structure, the statistical analysis must account for the nested structure in order to avoid inflating type I error (Kreft & De Leeuw, 1998; Pedhazur, 1997; Raudenbush & Bryk, 2002; Stevens, 2002). HLM is particularly suited for nested data since it allows for the examination of group level effects on individual outcomes. As a result, I was able to investigate the relationships among constructs that are embedded at multiple levels of analysis (Snijders & Bosker, 1999). The benefit of using HLM as opposed to OLS regression was that I avoided a potential violation of the independence assumption and I reduced the likelihood that standard errors would be underestimated and Type I error would be inflated.

The first finding that resulted from the analysis of the null model was that there were significant differences in time 3 scores of SRL between groups, even after controlling for students' beginning SRL. Moreover, results from this model showed that the group level variance was also statistically significant. A significant group level variance indicated there was variability at the group level that could still account for differences in SRLT3 scores even after controlling for prior SRL. In other words, there were other variables that could help to explain differences in groups' time three SRL scores, and thus it was appropriate to continue multilevel modeling. Testing the null model is necessary in HLM in that if between group differences in SRL time 3 scores were not significant, then there was no need to continue multilevel modeling. This finding was important because it suggested that there were increases in groups SRL as a result of working on this project. Thus, by controlling for beginning levels of SRL it was possible to infer how group's SRL processes changed over the course of their projects.

The remaining two HLM analyses investigated (1) if group condition predicted students' reports of their time 3 SRL, after controlling for prior SRL and (2) what variables (e.g., motivational orientations, prior SRL, coregulation, final group assessment, and/or features of the intervention) predicted time 3 SRL?

The first result suggested that students' condition (i.e., same, mixed age) was not a significant predictor of time 3 SRL scores after controlling for prior level SRL. That is, whether students were in a same-age or mixed-age group cannot help explain group differences in time 3 SRL scores. One explanation for this finding is that this was a highly complex, ill-structured task that was novel to all students. Because students do not engage in these types of tasks as part of their normal curriculum, group members in both same-age groups and mixed-age groups had to learn how to regulate cognition, motivation, and behavior on this novel task. Another possibility is that students were not far enough apart in age for there to be meaningful differences in their SRL attributed to age. That is, developmental effects may have been more important if students were further apart in age. Thus, including 8th graders in a group with 6th graders did not make it more likely that the group members would have higher SRLT3 scores. Instead, this suggested that other within-group variables related to group members' individual characteristics besides age explained why some groups had increases in SRL and some did not. Thus, because age was not an important predictor of differences in groups SRL, I examined other variables that may account for the differences between groups.

Research question 2 asked, Do motivational orientations, prior SRL, coregulation, final project assessment, and/or features of the intervention predict post-test scores of individuals' reports of SRL? A two-level HLM analysis was used to investigate this research question. First, groups with higher performance were more likely to have high SRL time 3 scores after controlling for prior SRL, motivational orientation, and perceptions of task features. This indicated that those groups who were successful on their end product also showed higher time 3 SRL, holding the other variables constant. One implication for this finding is that when groups performed well on this project, individual SRLT3 scores also increased. Because I controlled for other time 1 individual-level variables, this finding suggested that doing well on this project corresponded to improvement in group member’s individual SRL as well.

Similarly, the data suggested a positive relationship between coregulation and time 3 SRL, after controlling for groups prior SRL, motivational orientation, and perceptions of task features. This indicated that even after accounting for potential within-group differences in groups, their ability to effectively coregulate cognition, motivation, and behavior was a significant predictor of individual time three SRL. The importance of this finding is that it suggests that when groups coregulated effectively it corresponded to improvements in individual SRL. Thus, interventions to support effective group coregulation may likely correspond with increases in individual members SRL as well.

An examination of the slopes illustrated how a one-unit increase in various within-group variables led to a subsequent beta increase in time 3 SRL. For example, the data suggested a significant positive relationship between students’ motivation and time 3 SRL. That is, groups whose members had high motivation also showed more significant increases in their SRL over the course of the project. The implication of this finding is that it suggested a need to assess students’ motivational orientations prior to assigning them to collaborative work because regardless of what group students were assigned to, their motivational orientations had a positive relationship with subsequent improvements in SRL. Thus, if a student has low motivation, then interventions aimed at increasing their motivation before assigning them to group work are needed, if the goal is for group members to improve their SRL within the collaborative environment.

Next, the relationship between motivation and time three SRL was not significantly different for groups with higher/lower performance. In other words, the relationship between individual member's motivation and time 3 SRL remained consistent, regardless of whether students were in a successful or unsuccessful group. Thus, group performance was not a significant moderator of the relationship between individual motivation and SRLT3, which suggested that this relationship was resistant to the group's performance.

Another finding from this analysis suggested that the relationship between motivation and SRLT3 was stronger for groups with higher self-reported coregulation, while holding SRLT1 and perceptions of task features constant. In other words, coregulation had an interactive effect on the relationship between individuals' motivation and increases in their SRL. One implication for this finding is that interventions aimed at increasing or supporting effective coregulation processes in groups can improve (i.e., make stronger) the relationship between students motivation and SRLT3. Thus, there should be efforts to support these processes when students engage in group work.

There was a significant positive relationship between individuals' beginning level SRL and their SRL at time 3, while holding motivation and perception of task features constant. Thus, higher levels of beginning SRL corresponded to higher levels of SRL at time 3. The implication here is that students who had higher SRL to begin with also had the most significant improvements in SRL over the course of the project. Thus, interventions aimed at increasing SRL before students engage in group work may help support the development of their SRL in groups. Furthermore, this finding suggested that students' beginning SRL should be taken into account before determining the group's composition.

Next, the data suggested that the relationship between SRLT1 and SRLT3 was not different for groups with higher/lower final assessment rubric scores (i.e., performance), after holding motivation and perceptions of task features constant. This was consistent with the finding above regarding the relationship between motivation and SRLT3. That is, the relationship between group members' SRLT1 and time 3 SRL remained consistent, regardless of whether students were in a successful or unsuccessful group. Thus, group performance was not a significant moderator of the relationship between beginning level SRL and SRLT3, suggesting that this relationship was resistant to the group's performance. This lends support for the need to take into account individual level variables (e.g., prior SRL and motivation) before forming groups, because in this case the relationship between these individual level variables and SRL was resistant to the group's performance. Thus, interventions aimed to prepare students for group work by increasing motivation and SRL should correspond to greater improvements in their SRL over the course of the project.

Alternatively, there was a statistically significant effect of coregulation on the relationship between SRLT1 and SRLT3. That is, the relationship between these variables was stronger in successful groups when holding motivation and perceptions of task features constant. In other words, coregulation did have an interactive effect on the relationship between individuals' beginning level SRL and ending level SRL. One implication for this finding is that interventions aimed at increasing or supporting effective coregulation processes in groups, may improve the relationship between students' SRLT1 and SRLT3. Thus, groups with individuals who had high beginning SRL and who used effective coregulation processes had the most significant increases in SRL as a result of the group work.

The data also suggested a significant positive relationship between students' perceptions of task features and time 3 SRL. As such, increases in students' perceptions of task features corresponded to increases in SRL time 3 scores. This suggested that students' perceptions of task features are important, because they significantly predicted students' improvement in SRL over the course of this project. Thus, when designing a task it is important that students' perceive that the task (1) supports autonomy, (2) is interesting and optimally challenging, and (3) is valuable, because these features corresponded with increases in time 3 SRL.

In addition, the data suggested that the relationship between perceptions of task features and SRLT3 was not different (1) for groups with higher/lower final assessment rubric scores (i.e., performance) or (2) for groups with higher coregulation, after holding motivation and SRLT1 constant. Thus, the relationship between students' perceptions of task features and time 3 SRL remained consistent, regardless of whether students were in a successful or unsuccessful group or whether groups effectively coregulate. In other words, neither group performance nor effective coregulation were not significant moderators of the relationship between perceptions of task features and SRLT3, which suggested that this relationship was resistant to these group level variables.

Finally, the results of the OLS regression model suggested that groups' coregulated learning was a significant predictor of group performance. That is, groups who effectively coregulated cognition, motivation, and behavior also have had high projects assessment scores. This finding indicated that how well groups coregulated each other on this project corresponded to how successful they were on their projects. Because effective coregulation predicted high performance, the data suggested a need to support the use of these processes in collaborative learning environments.

CHAPTER FIVE

RESULTS AND PRELIMINARY DISCUSSION FOR THE QUALITATIVE DATA

To analyze the qualitative data in my research project, I relied on three main data sources: (1) the verbal transcripts of video data of students working on their collaborative projects, (2) information derived from students' group binders, and (3) students' self-reported survey responses. These data were used to answer research question number 3 (i.e., What self- and coregulated learning processes do students use to regulate cognition, motivation, and behavior); and research question 4 (i.e., for the groups analyzed in question 3, how consistent are students' reports of their SRL processes and coregulation processes with their observed regulation processes?) To do so, this chapter is organized into several sections. First, I provide a description of each groups' project, in order to highlight the purpose, process, and outcomes of the project. Next I provide an analysis of the processes students used to self- and coregulate cognition, motivation, and behavioral activities paying particular attention to patterns that underlie students' regulation processes within collaborative group interactions. This analysis consists of an analysis of both self- and coregulated forms of groups' regulation processes. Finally, I will present a descriptive overview of students' self-reported self- and coregulation processes from their responses to the *Self-Regulated Learning and Coregulated Learning* questionnaires. This information will be compared to findings from research question 3 to determine how consistent students' self-reports of their regulation processes are with their observed regulation processes over the course of this project.

Descriptions of Group Projects

Group One: Designing an Energy Efficient Sports Car

Group 1, which consisted of four 6th grade males, determined that they had a shared interest in cars and sculptures from working on their collaborative collage. The purpose of their project became to design an energy efficient sports car that relied on solar and hydrogen energy to power the car as opposed to gasoline. To design their car it was first necessary to research the parts of a gasoline powered sports car (e.g., structural features, safety features, design elements) and how gas moves through the engine to power the car. Their next step was to learn more about solar and hydrogen energy to determine if these energy sources could be used to power their car and if so, how each of these processes operated. For example, while researching solar energy, they learned that their car would need to be made of high-grade steel in order to withstand high temperatures and also which types of solar panels are most efficient for harvesting solar energy. They also learned about how hydrogen and solar power are converted into electricity to power their car. Finally, students researched the environmental benefits of using solar and hydrogen to power their proposed car. All of this information was combined to construct both external and internal designs of their energy efficient sports car and to create a mission statement for their company.

Group 2: Forming an All-Star Soccer Team

Group 2, which consisted of two 6th grade males and two 6th grade females, all shared an interest in soccer and decided that they would form an all-star soccer team for their group project. Using their knowledge webs, they learned that forming an all-star soccer team required them to research a number of elements. First, they would need to determine a systematic way to research players in order to choose the members of their team. To do so, they developed an excel spreadsheet to record potential players names, experience (measured in years), as well as summary statistics from the 2006-07 season (e.g., goals scored, number of yellow and red cards). This information was used to select the twenty-two members of their all-star team. After learning that players sign contracts when they join a team, the group members found an example sports contract and used this as a model to create their own contract for their team members. Their project also required them to design a logo and uniforms for their team members. In doing so, they researched lightweight and sweat/heat resistant fabrics as well as various types of cleats, gloves, and shin guards. Finally, they learned more about external members of the team such as support staff and medical team members. At the conclusion of the project, students reflected on how much research and decision-making was needed to form an all-star soccer team.

Group 3: Designing a Wing for the Museum of Natural History

Group 3 consisted of two 6th grade males and two 6th grade females, who were interested in learning about dinosaurs in the late Jurassic period. As part of their project they researched a total of twelve different dinosaurs from this period including information about their height, length, habitat, diet, weight, and classification. Their goal was to take this information to design a new wing for the Museum of Natural History in New York City. To gain a real-world perspective, the group contacted Donna Sethi, Director of Education for the Museum of Natural History. She provided them with information on the process researchers, scientists, and interior designers use to construct a new wing. While she did not have the exact dimensions of a typical space, she was able to tell them that the museum website had a scaled diagram of each floor and that the entire museum measured about four city blocks in length and width. Independently, students found that twenty city blocks was equivalent to one mile. They used the diagram on the website and this new information to calculate the dimensions of the space they would have to work with for the new wing. Once they calculated the dimensions of the space, they needed a way to organize how the fossils would be displayed. The strategy they used to do this was to organize the dinosaurs based on the geographic area in which they lived. Using the information on fossil width, height, and length found in their research, they determined the most efficient way to organize the wing. Finally, they made a scaled model of their wing and a number of educational activities to help potential visitors learn more about dinosaurs in the late Jurassic period.

Group 4: Designing a High Fashion Clothing Line

Group 4 consisted of two 6th grade females and two 8th grade females who were all interested in fashion. In their project, they researched current trends in fashion and then used these designs as templates for designing their own clothing line. They decided that their target market would be young career professionals who liked high fashion designs at affordable prices. As part of their research, they explored top designers' fashions and investigated altering these designs in order to minimize the cost of the clothing to the consumer. For example, a silk shirt by Calvin Klein was combined with a cotton shirt from Hollister. The new shirt was modeled as similar to the high fashion item, but materials/fabrics from the Hollister shirt were used to keep the cost of the shirt low. Once they designed all their clothing they developed a catalogue to showcase their designs. The catalogue included a picture of the item, a description of its material, the price they would charge for each item, and the available colors.

Regulatory Processes

The purpose of this section is to describe the types of self- and coregulated learning processes students used to regulate their cognition, motivation, and behavior and how these processes contributed to differences in students’ success on their projects.

Regulating Cognition

The literature on SRL has identified a number of regulatory activities students use to regulate their cognition. These include planning, monitoring, and evaluative processes.

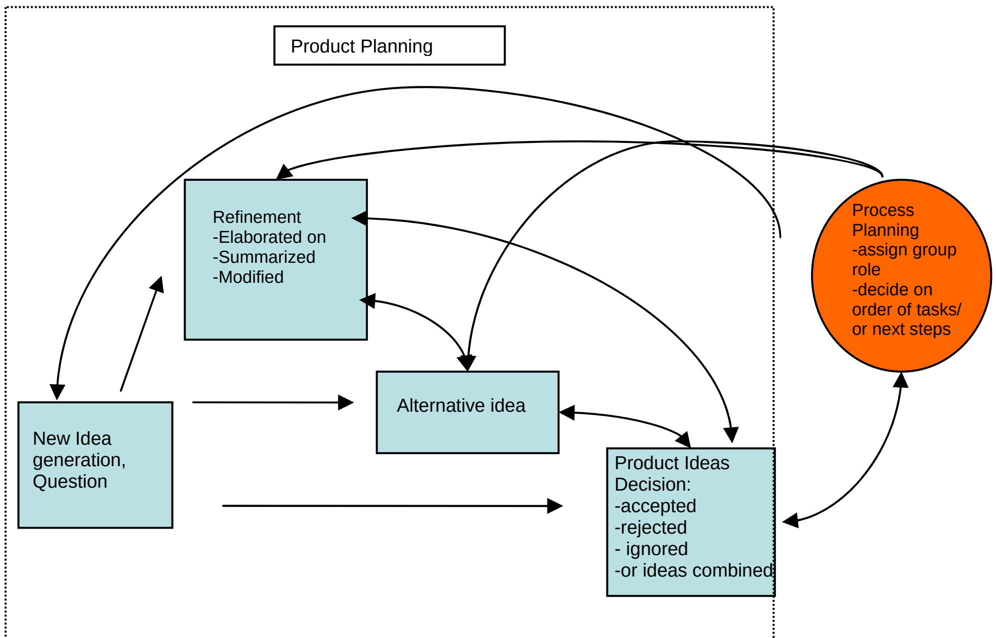
Planning

Planning activities are strategies individuals employ to define, organize, and prepare their projects. Extending this definition to the group context, a group member can also coregulate planning activities for another group member by defining, organizing, or preparing the project, or multiple group members can share in regulating planning activities together. While both examples are instances of coregulated learning, I will differentiate between when one individual plans for another group member or the group, and when multiple group members share in this process.

Planning as a whole consisted of two subprocesses—product and process planning (see Figure 5.0). Because of the open-ended nature of this task, it was important that students were able to plan both the content of their projects (i.e., product planning) as well as the steps they would take to carry out their projects (e.g., assign group members tasks, decide the order of tasks) (i.e., process planning). In Figure 5.0 the processes involved in product planning are indicated by blue squares, whereas the red circle indicates process planning activities. After I discuss product and process planning in each group, I conclude the planning section by discussing the interplay between these processes.

Figure 5.0

Planning Processes



Product planning involved defining the scope of the project and identifying its goals. The output of product planning was the development of project ideas. In general, the project ideas proposed could potentially go through an explicit process of refinement and ultimately be accepted, rejected, or ignored by the group.

More specifically, product planning began with a group member generating an idea or posing a question (e.g., “We’re going to make, guys we’re going make like own kind of car I guess, right?”). The idea could then be refined through (1) elaboration, (2) summarization, and/ or (3) modification. Note, however, from Figure 5.0 that refinement was not a necessary step. Alternatively, a new idea could lead to the proposal of an alternative idea, which in turn could also be (1) refined or (2) a decision can be made to accept, reject, or ignore this idea, (or 3) the alternative idea can be combined with the original idea. If a project idea was accepted, (1) it could be refined (in which case it would proceed through the same process described above), or (2) it could lead to process planning. If project ideas were rejected, it may lead to the proposal of alternative ideas, or the refinement of rejected ideas. Note that the development of new ideas can lead directly to a decision to accept, reject, or ignore these ideas, and this could lead to (1) refinement, (2) alternative ideas, or (3) process planning. Finally, as a result of process planning students could (1) develop new project ideas, (2) refine existing project ideas, or (3) propose alternative project ideas. As already mentioned, the interplay between product and process planning will be discussed in greater detail after examining all groups.

In all four groups analyzed in this research, product planning was a coregulated process. However, groups differ in the type of coregulated product planning in which they engaged. In some instances, one individual assumed product planning responsibilities for other group members or the entire group, while other times multiple group members shared in product planning together. Although counting the number of instances of product planning provides insight into quantitative differences in students' planning, it fails to capture these different kinds of coregulated learning processes students used to define the scope of their projects. Therefore, to investigate different trends in coregulated processes, I will provide a qualitative description of these data later.

When students engaged in process planning, they assigned group roles or decided the order in which they would complete tasks relating to a project idea. In process planning, their intent was to either self-regulate their own process planning or to coregulate process planning for others. When students self-regulated their own process planning, they assigned themselves a particular task or decided the order in which they would complete tasks. These included statements such as, “I found wheels and tires and now I’ll look for machinery” or “I will do this first and then look up the goalie information.” Alternatively, when students coregulated process planning, it entailed either one individual assigning another group member a task, or multiple group members sharing in assigning tasks to each other together. An example of the former would be when Mark plans for Gabrielle by stating, “Nobody has done this. Do the products. Do el products, do products.” Finally, examples of the third type of coregulated planning, that is, when multiple group members shared simultaneously in process planning together, is presented later. Therefore, the result of product planning was the generation of project ideas, whereas the result of process planning was the identification of tasks, assigning group members to complete these tasks, and deciding on the order in which to progress.

To support process planning, groups were provided with daily, weekly, and monthly calendars in their binders to facilitate their planning processes. These tools served as evidence of students’ discussions of their process planning, and thus provided another explicit record of students' process planning over the course of the project in addition to the video data. Therefore, as a final analysis of a group’s process planning activities I examined their group binder. To do so, in each group I recorded if the group engaged in process planning for the following day, and if their process planning was specific. Process planning was noted to be specific when the group members listed specifically what each group member would work on the next day. The specificity of students’ process planning served as one indication of the quality of students' process planning and may help to understand differences among the groups.

Monitoring

Group members also regulated their cognition using monitoring processes. Monitoring processes result from individuals comparing their performance to their goals, and then generating feedback that can be used to guide further action (Pintrich, 2002). In this research, students self-monitored how their own performance related to the group’s goals. They also coregulated monitoring processes. This occurred when a student monitored how another group member’s performance related to the group’s goals, or multiple group members shared in monitoring how each other’s performance related to the group’s goals together.

I also observed differences in what group members monitored. For example, sometimes group members monitored their process planning; that is, they monitored the status of the tasks they created through process planning (e.g., Who is researching stegosaurus? Are you almost finished researching stegosaurus? Where did you leave off yesterday researching stegosaurus?). I referred to this form of monitoring as task monitoring. This type of monitoring typically reflected a Vygotskian approach to coregulation in that a group member would check on what another group member was doing. I labeled instances as task monitoring when a group member checked to make sure another member carried out the duty/ task they were previously assigned by the group, regardless of whether the duty/task was assigned verbally or written down in the group binder. For example, after Nate observed Barry researching solar energy when he was supposed to research hydrogen fuel cells, he asked Rick, “Why is he [Barry] doing that?

He is supposed to be looking up hydrogen." In this statement Nate was in essence monitoring the earlier established task in which Barry was assigned to research how hydrogen is used to power cars. Finally, there were also instances where a group member self-monitored a duty/task he or she was assigned. An example of self-regulated task monitoring occurred after Henry found an example contract as part of his research and stated "Ok, I am finished finding the contract." Here, he has noted that he has accomplished a task created earlier in process planning.

Group members also monitored their own and each other's ideas, research, and/or problem-solving related to the content of their projects. I defined these instances as content monitoring. When an individual engaged in self-regulated content monitoring it included statements aimed at monitoring the information he or she had researched related to the project. For example, as Rick researched information related to the cost of a single solar panel, he stated, "Where's the cost? Where's the cost? I can't find the cost! Oh, there it is. Oh there's the cost." This statement represented self-regulated content monitoring because Rick oversaw his own research efforts related to the content of the project. Content monitoring could also be coregulated. Coregulated instances consisted of either a single group member monitoring another member's idea, research, or problem-solving, or when several group members engaged in this process together. One instance of coregulated content monitoring occurred when Henry monitored Gabrielle by looking over the statistics she found on each player. He stated, "Wait, what do you have? What do you have on players' stats in there?" Here, Henry monitored the information Gabrielle researched related to the project.

To reiterate, while task monitoring refers to monitoring the status of tasks inherently created through process planning (e.g., Who is researching cleats?), content monitoring refers to monitoring the information students gathered in support of their ideas formed in product planning (e.g., What research did Gabrielle find on cleats?). Finally, an important distinction in content monitoring between the groups, which I will discuss in greater detail later, concerns whether group members monitored how the information they found contributed or related to their project ideas. While all groups monitored each other's ideas, research, and problem-solving to some degree, only some groups made the extra effort to monitor how ideas, research, or problem-solving were important and/or necessary to their end product. In other words, Henry may monitor the information Gabrielle found on cleats, but do either of them explicitly monitor how this information connects to their project goals? This may be an important distinction in understanding how groups monitored, and this will be discussed in greater detail later in the paper.

Group members also engaged in monitoring understanding while working on their projects. Self-regulated forms of monitoring understanding refer to statements made by an individual that suggest he or she understands or does not understand his or her own actions or explanations. So when Diane researched clothing for Gerry to use to design clothes and responded, "I have no idea why I am doing this," she was monitoring her own understanding of their project. In other words, realizing that she did not know why she was looking for different clothes on the Internet is a form of monitoring.

Instances of coregulated monitoring for understanding were a little different. These were efforts by one individual to make sure that other group members understood a particular concept or action. In essence, it involved monitoring another group member's understanding of a particular point before moving on. An example of coregulated monitoring for understanding occurred when Henry made sure that all the group members understood how he chose the players, just in case they were asked about it during the group's presentation. It is important to note, that the latter example of monitoring understanding was very rare. That is, group members rarely engaged in efforts to monitor each other's understanding. Furthermore, there were no instances noted where group members shared in monitoring understanding together. Still when group members did engage in monitoring for understanding it may suggest a high level of commitment from the group members to ensure that there was shared understanding, an important aspect in ensuring that students were all working toward the same goals.

Evaluation

Evaluations refer to appraisals, corrections, or assessments students made about their own performance or that of other group members. When students evaluated their own performance, they appraised, corrected, or assessed their own work, and thus generated feedback that could be used to correct their own errors and misunderstandings. Alternatively, students also coregulated evaluation activities. Coregulation reflected a Vygotskian approach when a group member evaluated another group member's performance, or when multiple group members worked together to evaluate each other's work simultaneously on a joint task. Compared to total instances of planning (N = 432) and monitoring activities (N = 589), all groups engaged in fewer instances of evaluative statements (N = 60) over the course of their projects. When they engaged in these activities, however, there were differences in both the quantity and quality of group members' evaluations.

In general, the types of evaluative activities groups engaged in can be characterized into two types. The first type of evaluations included statements aimed to assess or judge content related to their project (referred to as content evaluation). Content does not necessarily mean written work and could include the assessment and correction of verbal statements related to the content of the project as well.[2] When content evaluation was self-regulated it involved efforts by an individual to assess and correct the content information in their own work. So if Adam wrote a paper and then evaluated the appropriateness of information he included in his paper, this would be an example of self-regulated content evaluation. Alternatively, coregulated content evaluation would refer to instances when a group member assessed and corrected content information presented by another group member. For example, one group member evaluated another group member's work. In addition, group members could have also shared in evaluating content information in a product simultaneously. An example of the latter form of coregulated content evaluation occurred when members of the car group worked together to assess and correct the content in their company's mission statement together.

The second type of evaluation students engaged in was aimed at assessing and correcting formatting, spelling, grammar, or punctuation errors (referred to as evaluating mechanics). When a student self-regulated efforts to evaluate the mechanical aspects of his or her work, he or she assessed and made corrections to grammar, spelling, or punctuation in his or her own work. Alternatively, when evaluating mechanics was

[2] Note, content monitoring referred to statements to monitor each other's work (e.g., "Julian, what does it say about the Elaphrosaurus") whereas content evaluations referred to judgments about the accuracy or relevance of the research (e.g., "that is, information is wrong").

coregulated either one individual assessed and corrected another group member's formatting, spelling, grammar, or punctuation, or several group members shared in these efforts simultaneously. Thus, when members of the car group assessed and corrected grammar and spelling on their company's mission statement together this reflected the latter form of coregulation.

Regulating Motivation

In addition to attempts to self- and coregulate one's own and fellow group members' cognition, group members also engaged in strategies aimed to regulate their own and other group members' motivation. Regulating motivation refers to processes individuals employ to start, persist, and finish a particular activity or goal (Wolters et al., 2003). In the group context, this definition is expanded to include processes individuals use to regulate other group members' motivation or when multiple group members share in regulating motivation simultaneously on a joint task.

Students engaged in a variety of strategies to regulate motivation in their groups (see Table 5.0). While in theory there could be instances where group members engaged in attempts to regulate their own motivation, as well as endeavors by multiple group members to share in regulating motivation simultaneously on a joint task, in this research I only observed Vygotskian forms of coregulation in which one group member regulated another group member's motivation. Thus, I did not separate these data into self-regulated and coregulated forms of regulating motivation as I had done for planning, monitoring, and evaluation processes, since there were only instances of coregulated efforts to regulate motivation observed in these four groups. Table 5.0 provides a definition for each strategy group members used to regulate motivation and example statements of each strategy.

Table 5.0

Definitions and Examples of Strategies Used to Regulate Motivation

	Definition	Example
Praise or encouragement	Statements made by group members to commend another group member	"Man, that's awesome! You're workin' now."
Agreement or understanding	Statements made to another group member that express agreement or understanding	"I get you."
Self-efficacy talk	Statements made to another group member to express confidence that he or she can accomplish a particular task.	"Yeah, focus, you can do it."
Relevance	Statements made to another group member to express how important something is to the task	"You should look for cheaper metals or anything like that 'cause that would really help us on our project."
Interesting/Cool	Statements made to another group member to express how	"That is so cool."

	interesting or cool an aspect of the task is	
Performance (extrinsic)	Statements made to another group member to link the group’s performance to an external standard (e.g., a grade)	“Come on if we don’t finish this we are gonna fail.”
Negative Self-efficacy (addressed at another group member)	Statements made to another group member that indicate lack of confidence in his or her ability to perform a task	“There is no way you can calculate that in your head.”
Verbal put down	Statements made to another group member to criticize him/her	“You suck, you know.”

Regulating Behavior

Regulating behavior refers to processes an individual uses to help control his or her behavior. In a group context, this definition is expanded to include processes individuals use to help control other group members’ behavior. I found that students engaged in self-regulated and coregulated efforts to control their own or each other’s effort or attention in order to sustain on-task behavior. Sometimes referred to as volition, this referred to a group member’s ability to control his or her own effort or attention, or another group member’s effort or attention. Instances of coregulating behavior either (1) reflected a Vygotskian approach in that one group member regulated another group member’s behavior, for example when Adam said to a group member, “Focus, we only have three slides to go" or when Henry said to Gabrielle, "Ok, but concentrate on finishing this one" or (2) when multiple group members shared in regulating each other's effort and/or attention simultaneously. Although I noted instances of regulating effort verses regulating attention within the collected data, for summary purposes here I indicated the total number of instances of regulating effort and attention combined. This was done because both processes served similar functions and thus differentiating them did not appear meaningful.

Self- and Coregulation Processes in the Car, Soccer, Dinosaur, and Fashion Groups

The purpose of the following sections is to investigate group differences in both the quantity and quality of students' cognitive (i.e., planning, monitoring, and evaluation), motivational, and behavioral regulatory processes over the course of the project. To do so, I discuss each group's cognitive, motivational, and behavioral processes, paying particular attention to different trends in how group members coregulated these processes. Because the context of students' regulate (i.e., the time period) may help to understand differences in self- and coregulation patterns, I divided the six-week total project period into three time periods. The time periods (i.e., Time 1, Time 2, and Time 3) refer to the first, second, and third, two-week period of the project, respectively. Time 1 referred to weeks 3 and 4, time 2 represented weeks 5 and 6, and time 3 corresponded to weeks 7 and 9.

The Car Group

Planning. The car group engaged in product and process planning throughout their project in order to define, organize, and prepare their project, and both forms were important to the group's success. An investigation of the car group's product planning

(See Table 5.1) indicated that there were 27 total instances of product planning over the course of their project.

Table 5.1

Number of Product Planning Instances for the Car Group over Time

Product Planning Processes	Time 1	Time 2	Time 3	Total
Idea Generation	7	0	0	7
Question	0	0	0	0
Elaborated	9	2	0	11
Summarized	3	1	0	4
Accepted	3	1	0	4
Alternative Idea/Reject/ Ignore	1	0	0	1
Total	23	4	0	27

The majority of these instances (84%) occurred during time 1. Students engaged in a number of subprocesses in product planning their project. For example, in the car group one particular instance of product planning began with a group member proposing an idea for the project. This project idea was then elaborated on by one or more group members, and summarized. Summarizing the idea was an important step toward clearly defining the project, and making sure everyone understood and accepted the proposed project idea. The members of the car group were more likely to elaborate on a particular group member's idea, rather than to reject or present alternative ideas. In time 2 there were four instances of product planning processes after students had researched more about hydrogen and solar energy and used this newly learned knowledge to elaborate on their previous project ideas. This idea was then summarized, and a series of process planning statements were suggested for how they would incorporate this knowledge into the design of their car. There was no instance of product planning during time 3 for this group. Thus, in terms of how many times the car group product planned over the course of the project, these data suggested that the car group engaged in the majority of product planning over the first two time segments of the project.

An analysis of which group members were responsible for product planning suggested that these processes were relatively equally shared among the group members, indicating that multiple students were involved in defining the scope of their project. For example, each group member engaged in instances of initiating product planning by generating ideas, and all members shared in elaborating on and accepting ideas. Thus, it did not appear that one group member was solely responsible for one or more aspects of product planning. The fact that all students were highly engaged in product planning until an idea had been refined, modified, and ultimately accepted may serve as one indication of the quality of this group's overall planning and explain why they achieved success on their project.

What was particularly interesting about the car group's product planning was that these processes reflected the second form of coregulation noted, in which multiple group members share in product planning processes simultaneously on a joint task. This point was well illustrated in the following excerpt. In the process of cutting out pictures of cars for their collaborative collage, the group members began to define their project by product planning what type of car they intended to design. The notion of developing an energy efficient sports car was not one individual's project idea; instead, all individuals coregulated product planning to arrive at a project idea that was accepted by all group members. The text in italics has been added to direct the reader's attention toward the salient points of the interaction.

> **Nate**—Group: We're going to make, guys we're going make like our own kind of car I guess, right? *(initial idea proposed by one group member)*
> **Rick**—Nate: Well, we have to agree on something, all together.
> **Nate**—Rick: But I'm saying we should make like our own car *(the idea is elaborated on)*
> **Barry**—Nate: But not a regular car— like one that uses solar or some other energy *(the idea is elaborated on and refined by another group member)*
> **Nate—**Group: so like an energy efficient car *(the idea is summarized for the group)*
> **Barry**—Group: it could be like an energy efficient Honda *(another idea is proposed but it is an extension of the original project idea)*
> **Adam**—Group: hey how about a sports car *(the idea is refined by another group member)*
> **Nate—**Group: an energy efficient sports car…cool *(the idea is summarized for the group) (regulates motivation)*
> **Adam**—Group: ok, so cut vehicles, cut out any sports car vehicles. *(a direction is given for how to proceed toward accomplishing the project idea, this is the beginning of process planning)*

Notice how product planning processes in this excerpt were shared by all group members and the project idea (i.e., to build an energy efficient sports car) resulted from each member building on/ making modifications to another group member's idea. All members spent considerable time working together to define and refine project ideas. This level of product planning for the car group was explicit and occurred early on, which may serve as one indication for why they only slightly modified project ideas developed at time 1 during time 2, and made no changes to their finalized project ideas in time 3. This finding is illustrated in Table 5.1 in that there were no instances of new idea generation in times 2 and 3. This coupled with the increase in process planning (discussed below) at time 2 may indicate that once group members had established well-defined project ideas primarily during time 1, the majority of their planning efforts during time 2 were spent delegating who would carry out the various tasks of their project, and what order they would complete tasks via process planning. Finally, students' efforts to coregulate their product planning may have led to the development of intersubjectivity and a shared goal for the overall project. The development of intersubjectivity and shared product planning may account for why group members worked positively and collaboratively process planning during time 2 and time 3.

Turning now to an analysis of process planning for the car group, Table 5.2 provides the number of process planning instances recorded in each time period.

Table 5.2

Number of Process Planning Activities for Car Group over Time

Process Planning	Time 1	Time 2	Time 3	Total
Self-	0	7	0	7
Coregulated	14	29	13	56
Total	14	36	13	63

Recall that process planning is when group members assign duties or tasks to themselves or other group members. The car group had 63 instances of process planning over the course of their project. 76% of these processes occurred during time 2. Relative to the number of coregulated process planning instances (n = 56), I observed fewer instances where members of the car group self-regulated their own process planning (n = 7). That is, students were more likely to coregulate process planning than to explicitly assign tasks or the order of tasks to themselves. This does not mean, however, that group members did not assume responsibility for certain tasks without being assigned those tasks, but they did not explicitly voice that they were doing so.

There were different types of coregulated process planning instances in the car group. The first type reflected a more Vygotskian approach to coregulated learning in that one group member assigned a task to another individual. Alternatively, there were also instances in which multiple group members shared in process planning simultaneously. This next example reflected this second form of coregulation because multiple group members shared in assigning tasks to each other while they reviewed their knowledge webs and decided on what they needed to do the next day.

> **Nate—**Barry: We kinda gotta do some planning and stuff right now. Get the binder.
> **Barry—**Group: Ok, first, we need to research the solar panel and its cost. Who is going to do that? *(Barry has the binder and is writing down what everyone will do)*
> **Adam—**Rick: Rick, you do that because you found the information on solar energy
> **Barry**—Adam: Ok, well, Adam you help him with that.
> **Rick—**Barry, Nate: Ok, so we got to find out the cost of one solar panel. You guys find the cost of hydrogen.
> **Nate—**Rick: Ok, we will do that, write it down.

In this excerpt process planning was not self-regulated (in which an individual process planned for himself), nor was it Vygotskian coregulated (in which an individual assigned tasks to another group member). Rather, multiple group members participated in process planning by assigning tasks for tomorrow's class together. Note how the initial task proposed by Nate was refined by Barry who suggested that they needed "to research the solar panel and its cost." Adam assigned Rick to do this task, and Barry suggested that Adam also work on finding the cost of a solar panel. Rick summarized what he and Adam would work on tomorrow, and then assigned Barry and Nate the task of researching cost information related to hydrogen. Finally, note that the individual responsible for assigning tasks to other group members alternated among the group members. In other words, there was not one particular individual who always coregulated for other group members; instead, all group members assumed this role at various points throughout the interaction.

Recall that I also collected evidence of students' process planning in their group binders through their daily, weekly, and monthly calendar sections. Of the total number of days students had to work on their projects, the car group process planned 96% of the time. I also evaluated the specificity of their process planning. Process planning was noted to be specific when the binder entry explained explicitly what tasks each group member would work on the next day. This became an important determinant of the effectiveness of their process planning, and thus what group members accomplished during a given class period. That is, when process planning was vague (i.e., it was not clear who was researching solar energy) then the next day students spent a considerable amount of time at the start of the period process planning again. On the other hand, when process planning was specific then the next day students began tasks immediately without needing to reengage in process planning. The car group's process planning was specific 56% of the time.

To reiterate, in the car group, planning as a whole consisted of coregulated product planning, and self- and coregulated process planning. Product planning, highest in time 1, included a number of subprocesses that students used to refine their ideas until they had constructed well-defined project ideas that were accepted by all group members. Thus, group members formed a shared understanding and reached a mutual agreement on the scope of their project. Process planning, highest in time 2, consisted mainly of coregulated efforts in which group member's assigned tasks to each other in order to carry out their project ideas. This served to organize the execution of aspects of their project over the course of the remaining weeks. In addition, students used their binder to help them with their process planning. When process planning in the binder was specific, it served as a record of each group member's task responsibilities, which helped facilitate process planning efforts over the course of their project.

Monitoring. Table 5.3 provides the monitoring processes that the car group used to regulate their projects over time.

Table 5.3

Monitoring Processes for Car Group over Time

	Time 1	Time 2	Time 3	Total
Task Monitoring				
Self-	0	1	2	3
Coregulated	10	22	3	35
Total	10	23	5	38
Content Monitoring				
Self-	1	6	6	13
Coregulated	0	37	24	61
Total	1	43	30	74
Monitoring Understanding				
Self-	0	3	0	3
Coregulated	0	0	1	1

Total	0	3	1	4
Total	11	69	36	116

Overall, the group monitored a total of 116 times. 59% of their monitoring processes occurred at time 2, and 31% of these processes occurred at time 3. Of the total number of monitoring processes, 38 instances related to task monitoring. Even though there were ten instances of task monitoring during time 1, the majority of these statements were made during time 2. This finding was not surprising as the car group spent a majority of time coregulating product planning processes during time 1. As such, the increase in task monitoring during time 2 may have suggested that for the car group monitoring became more important after they had established well-defined project ideas (through high product planning instances) during time 1 and started assigning group members to certain tasks (high process planning instances) to achieve the project goals. Once this was done then efforts could be made during time 2 to monitor the duties of the individual group members. For the car group task monitoring typically involved coregulated efforts by one individual to monitor if another group member was working on his or her assigned task or duty. This role was not assumed by one individual and instead rotated among group members rather equally. There are examples of all members task monitoring at various points throughout the project. During time 1 while students worked on filling out knowledge webs in pairs, Rick asked Barry (who was working with Adam) if he had finished filling out the knowledge web on solar energy. Nate also monitored Barry in an instance during time 2 when he asked whether he had finished finding the information related to safety features. I did not observe any instances where group members shared in task monitoring together. Similar to the car group instances of process planning, there were few instances where group members made explicit self-regulated statements that showed they were task monitoring.

Monitoring played an important role in how the group members regulated their project. For the person who did the monitoring, he or she benefited from being able to practice monitoring processes which could lead to the refinement of these processes over time. Here, because all group members monitored fellow group members at various points throughout the project, they all had practice refining their monitoring skills. Alternatively, for the individual who was being monitored, it could serve to refocus attention on-task and help maintain on-task behavior (refer to the example above when Nate monitored Barry). The group as a whole also benefited from its members checking that everyone was doing what they were assigned. By ensuring that everyone fulfilled the tasks assigned to them during process planning it increased the likelihood that all parts of the project were completed, and provided an opportunity for group members to revise tasks if a particular group member did not fulfill his or her assigned role, or new information was discovered that would alter process planning. For example, at one point during time 2 Barry was supposed to be researching safety features, and Nate monitored his process planning and concluded that he was not on-task. He reminded Barry that he was supposed to find the information on safety features, and Barry discontinued flipping through the library book and resumed his research on safety features. Another likely outcome that could have resulted from Nate’s monitoring would be that Nate (having learned that Barry did not fulfill his role) modified process planning (alone or with other group members) by reassigning the task to another group member. Either way, by monitoring, these group members took steps to ensure that the tasks established through process planning were carried out, which was important to the group's overall success.

Turning now to how students engaged in content monitoring, the quantitative data (see Table 5.3) suggested that members of the car group made statements related to content monitoring 74 times over the course of the project. Content monitoring was highest during time 2, which was not surprising since this was when group members were gathering information related to their project. Thus, there was more for them to monitor. Similar to task monitoring, the majority of statements related to content monitoring were coregulated. In the car group however, how students coregulated content monitoring reflected both a Vygotskian approach to coregulation in that one group member monitored another group member's ideas, research, or problem-solving, and involved instances where several group members shared in this process together.

An instance of content monitoring that reflected a more Vygotskian approach occurred during time 2. Nate and Rick had been working on research related to how hydrogen fuel cells work to store energy to generate power to run a car, and they discussed this process together. Adam, who overheard their conversation, monitored them with a series of questions. For example, he asked, "How does hydrogen charge it [the battery], where does it get the energy for that?" This question was intended to monitor the research Nate and Rick collected and to ensure that it was relevant to the goals discussed in product planning. This type of monitoring benefited the group members in several ways. First, it allowed Adam access to research that Nate and Rick were working on, and as a result increased his knowledge of hydrogen energy and helped him form a more complete understanding of content related to the project. Second, for

Nate and Rick, Adam's monitoring served as a check to make sure they understood what they were researching, and helped to ensure their research was complete. Thus, when group members were all involved in monitoring each other's work it allowed for the identification of inconsistencies, misinterpretations, or gaps in the research, which when addressed, led to a better quality product.

This group also engaged in content monitoring in which all group members shared in monitoring research gathered related to the project. In this next excerpt, Adam, Nate, and Rick all monitored each other's ideas on how hydrogen would be used to power their car. This interaction was coregulated in that all members shared in monitoring processes.

> **Adam –** Nate, Rick: What did you find on hydrogen? *(content monitoring Rick and Nate's research on hydrogen)*
> **Rick –** Adam: Ok, it gets heated inside the car, and then this makes kinda makes like a pressure which makes the car run
> **Adam –** Nate: well hot water heats the engine and then the steam comes out from the tube. *(content monitoring Rick's explanation)*
> **Rick –** Adam: Isn't that what I said? *(Rick content monitors)*
> **Nate –** Rick: But it comes out, you said it stays inside the car. *(Nate content monitors Rick's explanation)*
> **Rick –** Nate: I never said it stays inside the car, I never said anything about staying *(Rick self-monitors)*
> **Nate –** Rick: Anyway, the steam leaves the car
> **Adam -** Nate: Well we gotta put some kind of thing for the steam to leave from *(Adam is product planning based on the results of the research)*
> **Rick –** Nate: yeah like a tube or it says we could have a vent (*Product planning)*
> **Adam -** Nate: Alright, so I gotta, wait, hold up guys, I gotta change, where is my drawing, I gotta change this right here. I gotta put a vent here, right. So look the stream will go through this tube and then out here. Right? *(self-monitoring, modification of product planning)*

In this excerpt, Nate, Rick, and Adam all contributed to content monitoring. What resulted (i.e., an elaboration of project ideas to include a vent) was a product of all group members monitoring the information Rick and Nate found related to hydrogen in their research. Sharing monitoring activities benefited this group in several ways. First, each group member was involved in monitoring processes, which led to a greater number of individuals using their own knowledge and experience to examine each other's ideas and research. Because there were more individuals weighing in and checking on each other's ideas and research related to the project, not only did everyone benefit from increased and shared knowledge of the topic, but the quality of the project should have also increased as a result of the feedback. Second, sharing in monitoring processes also had the potential to lead to greater understanding for all group members. By monitoring each other's research and ideas, it pressed students to expand on and refine their original understanding. For example, because Adam was involved in monitoring processes, he brought his own knowledge of how hydrogen fuel cells function to power a car, and used this knowledge to build on and clarify Rick's understanding. Adam's understanding was also increased by the group members monitoring activities in that he came to realize that he would need to make changes to his drawing. Thus, monitoring in this group context led to increases in knowledge and shared understanding that resulted in feedback that improved the overall quality of the end product.

It is important to note that in this group content monitoring involved efforts to monitor how each other's research or ideas related to the group's goals. That is, when group members content monitored they also checked that each other's ideas and research were relevant and related to the goals of the project. This was an extra step in which this group engaged as they regulated their project. For example, Nate engaged in content monitoring when he asked Rick, "What did you find on solar panels?" Barry, however, went further and asked, "Ok, how is this going to help us with our design?" It was this explicit attempt to not only monitor what another group member was working on, but to also monitor how the information or idea related to the group's goals that was an important quality of monitoring processes illustrated in this group.

Finally, group members engaged in monitoring understanding. In the car group, there were only three instances of monitoring understanding and they occurred during time 2 (see Table 5.3). For example, in one instance Barry and Adam were working side by side on separate laptops researching solar energy. As Barry was reading he stated, "I still don't get it. What if, what happens if light comes in and its only twenty volts?" Here, Barry monitored his own understanding of the content he read about on the computer. By identifying that he did not understand a particular concept Adam is lead to stop his own research in order to assist Barry in understanding the principle. He explains,

> "See like light comes in and is changed to electrical energy in the panels, so like they, they store the energy. Then the energy moves through these wires to the batteries which hold the electricity. If there's too much electricity in here (*Referencing the first battery*), then the rest of it *(referring to the electricity)* goes directly to this one *(referring to the other battery)*, and if that is super full, the rest of it will go directly to the other one right here *(the third battery).* Then when you turn on the car the energy from the battery goes into the engine. And it powers up some gears to keep it turning."

It is not clear whether Adam would have provided this explanation had Barry not monitored his own understanding and explicitly stated that he did not understand. Thus, when students engaged in explicit monitoring of their understanding, it allowed for other group members to offer explanations of the concept. Because the information was accurate and clear it increased Barry's understanding of how solar panels create energy. Had Adam's explanation been incorrect or confusing, it would not have benefited Barry.

There were also examples in which group members coregulated monitoring understanding. These were explicit statements made by one individual to make sure that other group members understood a particular concept or action. In essence, it involved monitoring another group member's understanding of a particular point before moving on. There was only one instance where a group member checked to make sure the other group members understood before moving on to another topic. It occurred as Adam explained the final version of his drawing to the rest of the group members so that they could begin their power point presentation. He asked the group, “Do you get it?” In this case monitoring for understanding did not lead to further explanation as it did in the self-regulated example above. This was because everyone agreed that they understood the drawing and then the group moved on to constructing their power point presentation. In essence, the low number of instances of monitoring for understanding may suggest that group members assumed that they all shared a common understanding of a particular topic. In this group, because all members were actively engaged in product and process planning as mentioned earlier, perhaps all group members shared a common understanding of how solar and hydrogen energy functioned in their car. Thus the lack of explicit efforts to monitor understanding did not affect the end product. On the other hand, it could be that some group members’ understanding contained inconsistencies and misconceptions, and because one or more group members did understand, the affect of some group members misunderstandings did not affect overall group performance.

To reiterate, the car group engaged in various monitoring processes in order to regulate their cognition over the course of the project. These included statements aimed at monitoring tasks established through process planning, monitoring content related to the project and its goals, and monitoring each other’s understanding. Investigating when students monitored suggested that the car group engaged in the majority of monitoring processes during time 2. The increase in task monitoring during time 2 may suggest that for the car group monitoring was more important after they had established a well-defined project during time 1 and started assigning group members to certain tasks. Once this was done, then efforts could be made during time 2 to monitor the duties of the individual group members. For the car group task monitoring typically involved coregulated efforts by one individual to monitor if another group member was working on his or her assigned task or duty. This role was not assumed by one individual and instead rotated among group members equally.

Similar to task monitoring, the majority of statements related to content monitoring were coregulated. In the car group however, how students coregulated content monitoring reflected both a Vygotskian approach to coregulation in that one group member monitored another group members' ideas, research, or problem-solving, and content monitoring also involved instances where several group members shared in this process together. It is important to note that in this group content monitoring involved efforts to monitor how each other's research or ideas related to the group's goals. That is, when group members content monitored they also checked that each other's ideas and research were relevant to and related to the goals of the project. Finally, there were both self-regulated and coregulated instances where group members monitored understanding.

Evaluation. The car group made statements aimed at evaluating both the content and mechanics in their project. Table 5.4 provides the number of instances of evaluation processes that the car group used to regulate their projects.

Table 5.4

Evaluation Processes for the Car Group over Time

	Time 1	Time 2	Time 3	Total
Content Evaluation				
Self-	0	0	3	3
Coregulated	0	2	6	8
Total	0	2	9	11
Evaluating Mechanics				
Self-	0	0	1	1
Coregulated	0	1	8	9
Total	0	1	9	10
Total	0	3	18	21

Overall, the car group evaluated 21 times over the course of their project. There were few instances of evaluation processes during time 2, with the majority of evaluative statements made during time 3. This finding may be explained by the fact that the car group spent the majority of time 1 establishing product and process plans, and time 2 monitoring their process plans. Then in time 3 as the group combined their individual research together to create the joint products of the project (i.e., the diagram of the car and the company's mission statement), they engaged in evaluative processes to assess and correct these products. This is not to say that there were not monitoring activities in time 3 or evaluative processes in time 2, it is just that the majority of monitoring processes occurred in time 2, and the majority of evaluation processes occurred in time 3.

There were three instances where individuals made statements evaluating the content of their own work. An example of self-regulated content evaluation occurred when Adam read aloud the paragraph he had written to contribute to the group's mission statement. He read, "Bran Enterprise's car is more fuel efficient because it uses solar energy to power the M2JC; no, that's not right, it's solar and hydrogen energy. Bran Enterprise's car is more fuel efficient because it uses solar and hydrogen energy to power the M2JC," and continues reading. This instance is an example of self-regulated content evaluation because Adam made a judgment about the content of his statement (i.e., that it is not correct). His evaluation resulted in feedback that he had to also include hydrogen energy in his paragraph or he would have excluded a major aspect of their project. Thus, similar to monitoring processes the benefit of a student evaluating his or her own work was that it resulted in feedback that could improve the quality of the group's project.

There were also eight instances when group member's coregulated content evaluation processes. Coregulation was noted in two forms. In the first form a group member coregulated another group member by evaluating the content of his or her work. In the second form group members shared in coregulating evaluation processes simultaneously on a joint task. An example of the first form of coregulation occurred when Rick made an outline for the company's mission statement and proposed that he was going to make a second outline as well. Nate examined his outline and stated, "Alright you just need to like you don't need a second outline this one is fine the way it is." As a result, the group members moved forward using the initial outline Rick created. There were several benefits that resulted from group members evaluating each other's work. By evaluating another group member's work the evaluator learned about the content that the other group member was writing about. For the person being evaluated, he or she received feedback on their work which may have led to corrections that would improve the overall quality of the product. Additionally, the person being evaluated benefited from exposure to the evaluator's strategies which he or she may in turn use on future projects. Finally, being evaluated may require the individual to reiterate his or her thought process related to the content. This revisiting of the content may have helped to solidify the individual's understanding or could possibly have exposed inconsistencies and errors which could then be corrected. It is important to note that in the car group there was no single individual who always evaluated the other group member's work. Instead this role was assumed by all group members at one point throughout the project.

Turning now to evaluations aimed at assessing and correcting the mechanics in one's own and each other's work, there were 10 instances of these evaluation processes over the course of the project. Almost all of the corrections to students' spelling, grammar, or punctuation were coregulated. One type of coregulated evaluation was when one group member evaluated another group member's work in terms of its grammar, spelling, and punctuation. An example of this type of coregulation occurred as Nate read aloud his paragraph for their mission statement. While he read, he stated the word "worser" referring to the effects on global warming if more energy efficient solutions are not developed. Adam coregulated Nate by stating, "No, that's not a word. It's worse," which led Nate to correct his grammar. The benefit of coregulating for Nate was that he received feedback on his work, which he in turn used to correct his error.

The car group was the only group to share in coregulating evaluation processes over the course of their project. This type of shared coregulation occurred once when the group members worked together to evaluate the final version of their mission statement simultaneously. In this discussion there were examples of both content evaluation and evaluating mechanics that occurred at once. The excerpt below was an example of shared evaluating in that each group member participated in evaluating the mission statement. (Note: Rick had the computer)

> **Nate –** Rick: This is wrong… we gotta say why we are using hydrogen and solar. Why both of them. *(evaluation)*
> **Rick –** Nate: Energy can be… what does this mean? That is why solar, that is why we use water and solar energy because it will lower *(evaluation)*
> **Adam –** Rick: Because it will be better for the environment
> **Rick –** Nate, Adam: (*Looks at the computer and reads*) However, oh! However! *(evaluation, realizes they need to include the word "however")*
> **Nate –** Rick: There is a thing down there that we have to fix. We have to fix it. Why isn't it working? Nice. *(evaluation)*
> **Rick –** Nate: Uh huh. Watch out let me do it.
> **Adam –** Rick: (*Points to the computer*) Yeah, this doesn't make any sense. *(monitoring)* (*Reads from the computer*) Fossil fuel is continued to be used. Fossil fuel is still being used.
> **Nate –** Rick: Fossil fuel is still being used? *(monitoring)* No. *(evaluation)*
> **Adam –** Rick: No, wait… our planet will die if fossil fuel is to be continued, is continued to be used… *(evaluation)*
> **Rick –** Nate, Adam: Wait, our planet will die if we continue using fossil fuels…
> **Nate –** Rick: I don't know about that. It will die? *(evaluation)*
> **Nate –** Rick: Wait, wait, wait, wait. *(regulating effort)* First of all, you've got to put a space. Ok. *(evaluation)*

In this example, the group members evaluated both the content of their mission statement and its grammar, spelling, and punctuation. This was an example of shared coregulation in that multiple group members engaged in evaluation processes simultaneously on a joint task. There were several benefits to the group members when they shared in evaluating processes together. First, because multiple group members were involved in evaluation processes, a greater number of individuals used their own knowledge and experience to assess and correct each other's work. This made it more likely that errors were identified because more group members were checking for them. Finally, when multiple group members shared in evaluation processes simultaneously on a joint task, they built on and refined each other's evaluations which in this case resulted in feedback that improved the overall quality of the end product.

It is important to note that when group members in the car group evaluated each other's work, their evaluations were specific. Thus in the example above, Nate did not simply tell Rick that his work was wrong. Instead he explained specifically why his work was incorrect (e.g., "This is wrong… we gotta' say why we are using hydrogen and solar. Why both of them?). Evaluation processes that were specific benefited the group members more than those that were vague. This was because they verbalize the rationale behind why the correction was needed. It is possible that when students understand why they need to correct an error, they may be more capable of evaluating their own work in the future.

Thus, the car group evaluated both content related to their project and assessed and corrected their own and each other's grammar, spelling, and punctuation. The majority of evaluation processes in this group were coregulated. Coregulated evaluation processes reflected both a Vygotskian approach in which one group member evaluated the content or mechanics of another group members work, as well as instances when group members shared in these processes. The car group was the only group to engage in this sort of shared coregulation. Finally, statements aimed at evaluating their own and each other's work had several benefits such as leading to a better quality product.

Regulating motivation. Table 5.5 provides the number of instances in which members of the car group used each strategy to regulate motivation over the course of their project.

Table 5.5

Instances of Strategies the Car Group used to Regulate Motivation over Time

	Time 1	Time 2	Time 3	Total
Praise or encouragement	1	0	2	3
Agreement or understanding	2	0	0	2
Self-efficacy talk	1	0	1	2
Relevance	0	0	2	2
Interesting/ cool	4	5	1	10
Performance (extrinsic)	0	0	0	0
Negative self-efficacy	0	0	0	0
Verbal put down	0	0	0	0
Total	8	5	6	19

Overall, the car group used five different strategies to regulate each other's motivation, and these totaled 19 statements aimed at regulating motivation over the course of their project. The trend over time of *when* students attempted to regulate motivation suggested that instances occurred more often in times 1 and 3. Of the five strategies members of the car group used to regulate motivation, statements made to express how interesting or cool an aspect of the task was were used most often, for example, during time 1, Adam proposed an idea to use multiple batteries at various points throughout the car so that the vehicle could hold more than enough energy to operate. Rick replied, “Yeah, that could be so cool” which encouraged Adam to continue describing his idea by explaining where in the car the batteries would be positioned. Rick’s statement thus served to regulate Adam’s motivation in that it promoted his continued engagement with the content and reinforced that his contributions to the discussion were valued. It is possible that if Rick had suggested to Adam that his idea was not interesting, this may have conveyed to Rick that his idea had little value to the group, and as a result Rick may have ceased participation. Thus, when a group member (A) engaged in an activity and turned to another group member (B) for their feedback, the initial judgments of group member (B)’s interest could potentially determine group member (A)’s persistence or termination within that task. This is because statements that conveyed interest in another group member’s contributions suggested that the contribution was valued (Hidi & Ainley, 2008). As such, statements that suggested to another group member that his contributions were interesting or cool were important in that they had the potential to increase participation and persistence in the task.

Similarly, attempts to praise/encourage another group member or foster his or her self-efficacy also served to sustain that group member’s participation and persistence in the task. For example, Barry was assigned during process planning to research hydrogen energy. Upon hearing this, Barry shrugged his shoulders and made an exaggerated display by plopping his head on his hand. Adam replied, “Oh don’t worry… You can do that!” This statement conveyed to Barry that Adam had confidence in his ability to research hydrogen energy effectively. When group members received feedback that indicated confidence in their abilities, it had the potential to increase their self-efficacy.

Furthermore, an increase in self-efficacy could result in increased persistence and engagement in the task if students adopted these beliefs. This was the case in the example above in that Adam’s confidence in Barry’s ability to complete the task resulted in Barry effectively researching hydrogen energy for the next two days. Similarly, a group member’s attempts to praise/encourage another group member also had the potential to increase persistence and engagement in the task as well.

Finally, when a group member made explicit statements that he agreed with/understood another group member’s contribution, this coregulated motivation in that it conveyed a sense of shared understanding and communicated that the contribution was valued. Furthermore, when group members believed that their contributions were valued, it likely increased persistence and sustained engagement in the task. For example, in one instance Adam explained to Rick a project idea he had for how to design the car. He stated, “Like, like, you know like a fin you know like mostly like racecars have those fins in the back…well solar energy will hit it and then there’s like something like that saves that energy… like collects it so that the car can run.” Rick replied, “Oh, yeah I get you. I get you, it will store the energy” which served to convey to Adam that his explanation was clearly understood and valued. In turn, Adam further elaborated on this idea and eventually this idea became a permanent feature in their car.

Because all of these strategies were effective in that they increased participation, persistence, and/ or engagement in the task for members of the car group, I have defined them as productive strategies. Furthermore, after reviewing the data, it did not appear that one group member was more likely to regulate another group member’s motivation.

Instead all group members made statements that served to regulate each other's motivation over the course of their project.

Regulating behavior. Table 5.6 provides the number of self- and coregulated instances in which the group regulated behavior over the course of the project.

Table 5.6

Instance of Self- and Coregulated Instances of Behavioral Regulation over Time for the Car Group

	Time 1	Time 2	Time 3	Total
Regulating Effort or Attention				
Self-regulated	0	0	1	1
Coregulated	10	16	13	32
Total	10	16	14	33

The car group made 33 statements aimed at regulating effort or attention over the course of their project. In time 1 there were 10 instances of regulating behavior, in time 2 there were 16 instances, and in time 3 there were 14 instances. There was only one instance in which a group member self-regulated his own behavior. This occurred when Adam was working on integrating the results of the group members' individual research findings in order to create the diagram of the internal parts of their car. He spread the papers out in front of him, and stared at them for a couple of seconds. Then he stated, "Alright, alright, focus." The purpose of this statement was for Adam to manage his behavior by focusing his attention on the task at hand. This example illustrates how self-regulated statements made to regulate attention can serve to sustain on-task behavior and focus on the task at hand.

There were also 32 instances of coregulated efforts in which one group member regulated another group member's effort or attention over the course of their project. Here, a group member used reminders or directives to engage, reengage, and/or sustain another group member's on-task behavior. For example, one instance of reengagement occurred when Nate was researching on a laptop information related to hydrogen energy. Nate announced that it was Thursday and that on Thursdays he leaves early from school to go to his swim team practice. This led him into a description of his swim team including where they practice, his fellow team members, and so on for the next three or so minutes. The group members nodded their heads, which appeared to signal that they were paying attention to his story. Finally, Adam interrupted him by stating, "Alright let's go back to this" and Nate responded, "Ok." This suggested that Nate agreed with Adam that he should get back on-task. Furthermore, because Nate reengaged and refocused his attention back on-task, this example illustrates how Adam was able to coregulate Nate's behavior by refocusing his attention. Efforts to reengage students back on-task potentially benefited the group by ensuring that everyone was working toward accomplishing their project goals. Alternatively, there were also coregulated efforts to regulate behavior in order to sustain students' on-task behavior. These were statements like "Come on" or "Keep going" that served to increase students' efforts to persist in the tasks. Thus, group members coregulated effort or attention in order to engage, reengage, and/or sustain on-task behavior.

In the car group, the members also engaged in coregulated efforts to regulate behavior where coregulation was shared among multiple group members simultaneously. In the following excerpt multiple group members made statements to regulate each other's effort or attention as the group members engaged in product planning. In the example, Barry was trying to understand how the car would hold enough energy to power the car. Adam engaged in several attempts to focus the group members' attention so he could provide an explanation to help Barry understand how the car would work. Nate also coregulated the other group members' attention by attempting to refocus their attention on the task at hand. All of these attempts to coregulate one another's behavior were intended to sustain on-task behavior. I have added italics to focus the reader's attention on the attempts to regulate behavior that various group members used.

Barry – Nate: Yeah, but sooner or later it runs out. How is that useful?
Adam – Group: Look, look, look… *(regulating behavior)*
Barry – Nate: See that's the question she's going to ask you and then, then what are you going to do? You have to figure…what your gonna say exactly…
Adam – Barry, Nate: Yeah, no listen to my answer, give me that. *(regulating behavior)*
Nate – Adam: Why don't you let us talk? *(regulating behavior)*
Adam – Nate: No, no, no, no. Wait cause I am trying to like explain this to you guys *(regulating behavior)*
Barry – Adam: We need to ask questions because you know what I asked, she's probably going to ask ... too. Where is Rick? (Calls Rick who is across the room at a desktop computer) Come here…hurry up. *(regulating behavior)*
Adam – Group: Watch, pay attention. Alright look this (*Referencing the drawing*) is the battery, let's just make pretend right? These are like the wiring things and all that and this is like the solar thing. *(regulating behavior)*
Rick – Barry: What?
Barry – Rick: You gotta pay attention to this in case she asks us a question. *(regulating behavior)*
Rick – Barry: Ok
Nate – Barry: You helped us get off topic, please let's stay on topic. *(regulating behavior)*
Nate – Adam: It's the solar panel right? Alright go on. *(regulating behavior)*

In this excerpt, multiple group members engaged in coregulated attempts to regulate each other's behavior during product planning. Recall that Adam attempted to focus the group members' attention by stating, "Look, look, look…" Similarly Barry stated, "You gotta pay attention to this in case she asks us a question" to Rick to convey that he needed to focus his attention on understanding how the car would work. The excerpt is an example of the second form of coregulation in that it reflected a more shared effort by multiple group members to coregulate each other's behavior simultaneously. Thus, the group members engaged in two forms of coregulation in order to regulate each other's effort and attention. Coregulating behavior benefited the group by (1) engaging students, (2) reengaging students, and (3) sustaining effort and attention in the task at hand.

The Soccer Group

Planning. The soccer group also engaged in product and process planning over the course of their project. During product planning (see Table 5.7) the soccer group had a slightly greater number of product planning instances over the course of the project ($N = 38$) compared to the car group ($N = 27$).

Table 5.7

Number of Product Planning Instances for the Soccer Group over Time

Product planning	Time 1	Time 2	Time 3	Total
Idea Generation	4	0	0	4
Question	8	0	0	8
Elaborated	10	0	0	10
Summarized	4	0	1	5
Accepted/ answered Q	7	0	0	7

Alternative idea/Reject/ Ignore	4	0	0	4
Total	37	0	1	38

The majority of these instances (98%) occurred during the first time period of the project. The only product planning statement to be made during time three was by Henry and this statement simply summarized earlier project ideas. The soccer group differed from the car group, however, in who was responsible for product planning. Whereas in the car group, these processes were shared among the group members, in the soccer group, Henry was responsible for the majority of product planning. For example, Henry contributed three of the four project ideas and he was the only person who accepted proposed project ideas. Henry often elaborated on his own project ideas and summarized his project ideas for the group. There were three instances where Mark contributed to product planning by elaborating on project ideas. Gabrielle and Sandy, however, would just repeat project ideas that were already proposed by Henry. This finding suggested that the soccer group’s coregulated product planning was different than the car group. Instead of shared coregulation of product planning among the group members, coregulation in the soccer group reflected a more Vygotskian approach in that one individual (i.e., Henry) assumed the majority of product planning responsibilities for the rest of the group. Table 5.8 indicates the number of instances of the soccer group's process planning over the course of the project.

Table 5.8

Number of Process Planning Activities for Soccer Group over Time

Process Planning	Time 1	Time 2	Time 3	Total
Self-	9	1	1	11
Coregulated	30	22	15	67
Total	39	23	16	78

The total number of instances of process planning for the soccer group was 78, which, compared to the car group, suggested that they engaged in more explicit process planning instances over the course of the project. Almost 60% of these statements occurred during time 1 as students engaged in self- and coregulated process planning. Process planning efforts decreased during the remainder of the project period. Although there were nine instances of self-regulated process planning noted during time 1, I only observed one instance in times 2 and 3 of a student assigning himself or herself a particular role or aspect of the task. Similar to the car group, members of the soccer group were more likely to verbalize statements aimed at coregulating other member's process planning than their own. That is, they were more likely to assign each other tasks than they were to overtly assign themselves a task. As noted earlier, this does not mean that group members did not assume responsibility for certain tasks without being assigned those tasks, only that they did not explicitly voice that they were doing so.

In this group, process planning also reflected a more Vygotskian type of coregulation. For example, Gabrielle had just finished researching the information on different types of soccer balls. Henry noticed this and assigned Gabrielle the task of researching players' statistics. Thus, this example represents the form of coregulation in which one group member (i.e., Henry) regulated process planning for another individual (i.e., Gabrielle).

> **Henry –** Gabrielle: What are you going to do? (*Henry leans over and looks at her paper.)*
> **Gabrielle –** Henry: (*Gabrielle* reads from the paper on her desk) Umm.
> **Henry –** Gabrielle (*Henry looks over a paper on his desk.*) Research…on…
> **Henry –** Gabrielle: Do research player stats.
> **Gabrielle –** Gabrielle: Re…search…play…er…stats. (*Gabrielle writes this information down on a research page as she was speaking.)*

In this example, Henry assigned Gabrielle a task to carry out for the rest of the period. The type of coregulation reflected the typical definition in the literature in that one group member assumed responsibility for regulating another group member's process planning. This example was representative of the type of coregulation that occurred in the soccer group in that Henry consistently assumed responsibility for coregulating the other group members' process planning.

Recall that I also collected evidence of students' process planning in their group binders through their daily, weekly, and monthly calendar sections. Of the total number of days in which the group could have engaged in process planning over the course of the project, the soccer group process planned 88% of the time. As opposed to the car group in which the responsibility for recording process planning was more equally assumed by each of the group members, in the soccer group, Henry recorded process planning 95% of the time. This finding may serve to corroborate the earlier hypothesis that the type of coregulation in this group reflected a more Vygotskian approach. As mentioned earlier, I also evaluated the specificity of their record of process planning. For this group, their plans were specific 82% of the time. Recall that the car group's plans were specific 54%

of the time. The observed difference may have to do with the fact that in the soccer group Henry planned 95% of the time, and as a result the level of detail in process planning was more consistent.

The soccer group was similar to the car group in that both groups engaged in product planning which resulted in well-defined project ideas, and process planning to determine the tasks needed to carry out those project ideas. Where they differed is that product and process planning in the car group was more likely to be shared among the group members, as opposed to in the soccer group where one group member engaged in the majority of product and process planning for his fellow group members. This finding may help to explain why process planning instances were higher during time 1 in the soccer group. That is, in the soccer group’s project ideas were proposed by Henry early on and accepted with little modifications from the other group members. This allowed for process planning of how the project would be carried out to occur earlier on in the project. Perhaps if the soccer group had spent more time during time 1 coregulating product planning in a more shared fashion, the pattern of process/product planning instances would more likely resemble the car group. Since the soccer group’s final assessment score was equally as high as the car group, it may be that different forms of coregulation were equally effective in terms of final performance (that is, when performance was measured by a group grade).

To reiterate, the soccer group engaged in coregulated product planning and self- and coregulated process planning over the course of their project. Product planning was Vygotskian coregulated, and occurred during time 1 with few changes to the group’s project ideas over the remainder of their project. Specifically, Henry proposed project ideas that were adopted by the other group members, and group members spent the remainder of the time carrying out tasks assigned in process planning.

Monitoring. The soccer group also engaged in various monitoring processes in order to regulate their cognition over the course of their project. Table 5.9 provides the monitoring processes that the soccer group used to regulate their projects over time.

Table 5.9

Monitoring Processes for Soccer Group over Time

	Time 1	Time 2	Time 3	Total
Task Monitoring				
Self-	10	4	1	15
Coregulated	9	4	5	18
Total	19	8	6	33
Content Monitoring				
Self-	26	37	15	78
Coregulated	37	30	13	80
Total	63	67	28	158
Monitoring Understanding				
Self-	7	3	1	11
Coregulated	2	1	0	3
Total	9	4	1	14
Total	91	79	35	205

Overall, the soccer group engaged in more instances (*N* = 205) of monitoring than the car group (*N* = 116). The majority of monitoring occurred in time 1, and then slowly decreased over the course of the project. Of the total number of monitoring processes, 33 instances related to task monitoring. Unlike the car group, the soccer group engaged in the majority of task monitoring during time 1. Recall, the soccer group had a general understanding of their project idea early on in time 1, as opposed to the car group who spent the majority of time 1 product planning. Time differences in when groups finalized their project idea could possibly explain differences in when they began task monitoring. For example, since group members did not begin task monitoring until after they had established workable project ideas, the establishment of project ideas gave way to process planning and the creation of tasks which provided the group with something to monitor.

In the soccer group, group members engaged in coregulated efforts in which one individual monitored if another group member was working on his or her assigned task or duty. For example, group members decided that they would each take a knowledge web to fill out and Henry decided that Sandy would complete the knowledge web on designing uniforms. Two days after these tasks were established, Henry monitored Sandy, “Sandy, hey Sandy, did you finish your knowledge web… Sandy did you finish filling out the designing uniforms knowledge web yet?” In essence, Henry monitored Sandy’s task in an effort to ensure that group members were completing their assigned tasks. Unlike the group's process planning, which was assumed solely by Henry, the role of task monitoring rotated among group members equally. That is, there were examples of all members monitoring each other’s assigned tasks at various points throughout the project. Consistent with the car group there were not any instances of coregulated task monitoring in which all group members shared in monitoring each other's tasks simultaneously.

Referring back to Table 5.9, there were instances where individuals self-regulated their own task monitoring. To provide an example of this, notice how Gabrielle monitored what knowledge webs she was working on. Gabrielle stated, "Ok, Gabrielle, you finished the knowledge web on contracts, now what are you supposed to do? Uh, Uh. *(Gabrielle thought for a second)* Research player's stats. Henry, can you give me another knowledge web' thingie' for player's stats?" Here Gabrielle monitored her progress on an assigned task originally assigned to her by Henry thereby keeping herself on track with the group's process planning. In the soccer group, there were 15 instances of self-regulated task monitoring over the course of the project. This contrasted with the relatively few instances of self-regulated *process planning* on the part of the group members. Recall that Henry established well-defined project ideas and engaged in process planning which led to the assignment of tasks to group members during time 1. These coregulated efforts may have scaffolded the other group members' self-regulation in that Henry defined the scope of the task and assigned them group roles. Once this initial framework for the project was defined, it may have reduced the complexity of the task enough for all group members to begin contributing to self- and coregulated task monitoring processes. Of course this is only one possibility. Another alternative explanation was that because the majority of planning occurred during time 1 when group cohesion may have been low, during time 2 as students began to feel more comfortable working with each other they were more likely to participate in self- and coregulated learning processes.

Task monitoring (both individual and coregulated) played an important role in how the group members regulated their project. For the person doing the monitoring, he or she benefited from being able practice monitoring processes which may have led to the refinement of these processes over time. Moreover, when a group member monitored himself or herself it served to keep the group member on-task. In the soccer group, because all group members monitored fellow group members at various points throughout the project, they all practiced refining their monitoring skills. Alternatively, for the individual who was being monitored, it could have served to refocus attention back on-task and maintain on-task behavior (refer to the example above when Henry monitored Sandy). The group as a whole also benefited from its members checking that everyone was doing what they were assigned. By ensuring that everyone fulfilled the tasks assigned to them, it increased the likelihood that all parts of the project would be completed, and provided an opportunity for group members to revise their process planning if a particular group member did not fulfill his assigned role. For example, Henry reassigned Sandy task duties several times throughout the course of the project when monitoring revealed that she had not completed her assigned task. In one instance, Sandy was assigned the task of researching what material soccer balls were made of. The next day Gabrielle asked Sandy if she had finished looking up this information. When Gabrielle learned that Sandy had not completed her task, she told this to Henry, who assigned Gabrielle the duty of researching soccer balls. Thus, Gabrielle's monitoring of Sandy led to process planning changes.

Turning now to how students monitored content, the count data (see Table 5.9) suggested that members of the soccer group made statements related to content monitoring 158 times over the course of the project. Content monitoring accounted for almost 75% of the total instances of monitoring. Content monitoring was highest during time 2, which was not surprising since this was when group members were generating ideas and gathering information related to their project; hence, there was more information for them to monitor. Similar to task monitoring, the majority of statements related to content monitoring were coregulated. Whereas in the car group how students coregulated content monitoring reflected both a Vygotskian approach to coregulation, and also involved instances where several group members shared in this process together, in the soccer group there was no instance of shared monitoring.

There were examples, however, in which group members coregulated content monitoring throughout the course of the project. For example, Sandy made a knowledge web in which she brainstormed everything the group would need to research or make a decision on in order to make a soccer team. This included elements such as deciding on a name, designing the uniforms, and researching contracts. Gabrielle sat next to Sandy and glanced at her paper. She noticed that Sandy had written “permits” twice, and said, “You already wrote down permits.” This type of coregulated monitoring benefited Sandy in that Gabrielle helped her to identify a mistake in her work. In other words, when group members were all involved in monitoring each other’s work it allowed for the identification of inconsistencies, misinterpretations, or gaps in the research, which when addressed could lead to a better quality product.

A potential drawback to this group only engaging in coregulated monitoring processes that reflected a Vygotskian approach rather than more shared coregulation, was that group members did not benefit from receiving feedback from multiple individuals.

Moreover, even if everyone in the group had monitored Sandy’s knowledge web separately, for example, it would not have had the same result as when group members shared in monitoring simultaneously. This was because a particular group member’s feedback may have changed depending on the contributions of the other group members. Whereas in the current example, Gabrielle’s monitoring consisted of identifying an inconsistency in Sandy’s knowledge web, perhaps if Henry was also monitoring Sandy’s work and identified a gap in her research, this may have prompted Gabrielle to think of something else and thus the monitoring would have continued. Because this group was successful on their overall project, the fact that they did not share in coregulating monitoring activities suggested that this did not affect the quality of their end product. I do not know, however, if their project could have been even better had they simultaneously engaged in these processes.

There were also instances when group members explicitly self-regulated content monitoring. For example, as Sandy worked on the designing uniforms knowledge web she engaged in self talk, “Ok, I already put sizes, and I already put colors. What else is there?” Self-monitoring served as a way for her to self-check her research related to the task, and make sure that she did not duplicate something she already had. The instances of self-regulated content monitoring were higher in the soccer group than in the car group. Moreover, there were more instances of self-regulated content monitoring than there were self-regulated process planning. As suggested earlier, the increase in SRL may be attributed to the fact that once students established a shared understanding of a well-developed project idea; they were in a better position to monitor their progress toward accomplishing tasks from their process planning. Another possibility was that as students became more comfortable in the group, they felt more at ease verbalizing their SRL.

It is important to note that in this group content monitoring involved efforts to monitor how each other's research or ideas related to the group's goals. That is, when group members content monitored they also checked that each other's ideas and research were relevant and related to the goals of the project. For example, Henry engaged in content monitoring by asking Sandy about the research she found on the best material for their uniforms. Henry stated, "Ok because we need that information because some materials are better than others, like you don't sweat that much in them, and we need to know what materials so we can look up the costs." It was this explicit effort to not only monitor what another group member worked on, but also to show how the information or idea related to the group's goals that was important to understanding the quality of monitoring processes illustrated in this group. It is important to note that Henry was the only group member who engaged in this special form of content monitoring.

Finally, group members engaged in monitoring understanding. In the soccer group, there were eleven instances of monitoring understanding that occurred over the course of the project. These instances referred to statements made by the group members such as, "I don't know." Similar to the car group, the benefit of students making explicit statements about their understanding when they are working in the group was that they had access to fellow group members who could provide explanations. There were also coregulated forms of monitoring understanding. These were explicit statements by one individual to make sure that other group members understood a particular concept or action. In essence, it involved monitoring another group member's understanding of a particular point before moving on. There were three instances where a group member checked to make sure the other group members understood before moving on to another topic. In all instances, Henry was the group member who checked to make sure everyone understood before moving on. For example, when students put together their collaborative collage they included pictures of a number of famous soccer players in order to illustrate that their shared theme was soccer. Mark exclaimed that the group was finished, but Henry stopped him to ask the group members, “Does, does everybody know the names of these?” (Henry *gestures to a group of clippings on the collage).* When the group members shook their heads (no), this led him to explain who everyone was. Had Henry not checked group members’ knowledge of the different players, they may have been unprepared during their group presentation. Thus, monitoring for understanding helped to ensure that all group members shared a common understanding of material related to their projects.

Thus, the soccer group engaged in various monitoring processes in order to regulate their cognition over the course of the project. These included statements aimed at monitoring tasks, content related to the project, and each other’s understanding. Investigating when students monitored suggested that the soccer group engaged in the majority of monitoring processes during time 1. Time differences in when the group planned may possibly explain differences in monitoring processes. For example, group members did not begin task monitoring until after they had established project ideas and the establishment of project ideas and subsequent process planning provided them with something to monitor. Because the soccer group established their project goals earlier on in time 1, it may explain why monitoring processes began earlier than in the car group.

Both task monitoring and content monitoring consisted of self-regulated and coregulated instances. In the soccer group, when group members coregulated it resembled an approach to coregulation in which one group member engaged in task monitoring or content monitoring for another individual. Contrary to this group's planning processes, the role of monitoring rotated among different members of the group. This group also engaged in an extended form of content monitoring in which they identified how an idea or part of their research related to their end product. These forms of monitoring responsibilities were assumed by Henry. Finally, the soccer group engaged in self-regulated and coregulated forms of monitoring understanding.

Evaluation. The soccer group also made statements aimed at evaluating both the content and mechanics in their project. Table 5.10 provides the number of instances of evaluation processes that the soccer group used to regulate their projects.

Table 5.10

Evaluation Processes for the Soccer Group over Time

	Time 1	Time 2	Time 3	Total
Content Evaluation				
Self-	0	0	0	0
Coregulated	0	2	4	6
Total	0	2	4	6
Evaluating Mechanics				
Self-	0	0	0	0
Coregulated	2	2	3	7
Total	2	2	3	7

Total	2	4	7	13

There were 13 instances of evaluation statements made by the soccer group over the course of their project. In comparison to the car group ($N = 21$), the soccer group engaged in fewer evaluative processes. Similar to the car group the majority of evaluative statements were made during times 2 and 3. This trend made sense in that toward the end of their projects, students combined information to form their final product, and so they engaged in efforts to assess and correct their own and each other's work.

There were six instances where individuals made statements evaluating the content of another group member's work. Unlike the car group where there were instances of both Vygotskian types of coregulation and instances where coregulation reflected a more shared effort among group members, in this group all six instances involved instances of coregulation in which one individual evaluated the content in another group member's work. Examining the coregulated forms of content evaluation, I observed that in all six instances Henry evaluated another one of his group member's work. Thus, unlike the car group where responsibility for coregulating was equally distributed among the group members, here one individual assumed responsibility for evaluating the group members' contributions. Recall that a similar finding was observed with the soccer group's product planning. That is, Henry took responsibility for these processes as well. An example of coregulated content evaluation occurred when Henry examined the research page on contracts Mark had completed. Mark had researched contracts on Wikipedia and had written down its definition. Henry stated, "We need to find examples of different contracts, not just the definition of it. Like you gotta' like find some examples of sports contracts so we can use them to make ours." By evaluating Mark's research page, Henry identified insufficient information in Mark's work. This feedback led Mark to redo his research on contracts in order to find an example of a sports contract that the group could use to model their contract from. Additionally, if Mark engages in future problem-solving or design, he may recall that it is important to have examples to use as models. Thus, being evaluated may have resulted in the person being evaluated learning new strategies that were not part of his original repertoire.

Similarly there were seven instances in which a group member evaluated the spelling, grammar, and/or punctuation in another group member's work. Similar to content evaluation, responsibility for monitoring mechanics was also assumed by Henry. These instances of coregulation reflected a Vygotskian approach in that multiple group members did not engage in evaluation processes simultaneously. An example of coregulated monitoring of mechanics occurred when Mark tried to spell the word "negotiate." He attempted several times to spell the word, announcing each letter aloud. Finally, Henry stated, "Just write it and I will correct it [the spelling] later." Thus, Henry assumed responsibility for evaluating Mark's spelling. It is important to note that because Henry took over correction processes instead of correcting Mark's misspelling with him, this may indicate that Mark did not benefit from coregulated efforts of evaluation. While the quality of the end product had improved because Henry corrected the spelling, Mark did not learn how to spell it himself. Thus, this example illustrates the importance of evaluation processes being specific (i.e., identifying what is wrong, what the correction should be, and why it is correct) in order for it to benefit the group member being evaluated. It is also important to note that in this case the evaluator, Henry, made accurate assessments and corrections to group work; however, accurate evaluating is not a given, and inaccurate feedback could have hindered the quality of the project.

To reiterate, the soccer group engaged in statements aimed both at assessing and correcting the content and also the grammatical aspects of their projects. In the soccer group there were only coregulated efforts to evaluate, and all of these instances involved one group member, Henry, assuming sole responsibility for assessing and correcting content related and grammatical errors. When Henry provided an explanation for why a correction needed to be made (see the coregulated content evaluation example above) this resulted in benefits to the individual being evaluated. However, when Henry failed to explain why a particular correction was needed, there was no other group member engaging in evaluative processes that could provide this explanation. As a result, the end product was improved, but the individual being evaluated might not learn from his or her mistakes.

Regulating motivation. Table 5.11 provides the number of instances in which members of the soccer group used each strategy to coregulate motivation over the course of their project.

Table 5.11

Instances of Strategies the Soccer Group Used to Regulate Motivation over Time

	Time 1	Time 2	Time 3	Total
Praise or encouragement	6	0	8	14
Agreement or understanding	1	0	0	1
Self-efficacy talk	0	0	0	0
Relevance	0	0	0	0

Interesting/ cool	5	10	5	20
Performance (extrinsic)	0	0	0	0
Negative self-efficacy	0	0	0	0
Verbal put down	0	0	3	3
Total	12	10	16	38

Members of the soccer group made 38 attempts to coregulate motivation over the course of their project. Similar to the car group, the majority of instances occurred during times 2 and 3. In time 2, there were 10 instances of statements that conveyed how interesting or cool an aspect of the task was. Because research gathering activities occurred primarily during time 2, one interpretation of this finding was that group members were interested in each other's research.

Compared to the car group, the soccer group members made more attempts to verbally encourage each other to participate and persist in tasks. Examining the data showed that one group member, Henry, was the only group member to utilize this strategy to regulate the other group member's motivation. For example, in one instance Henry assigned Mark the task of determining how much it will cost to make their uniforms. Mark demonstrated that he realized this would not be an easy task when he replied, "That's going to be hard to find" and then Henry added, "Just try to do the best that you can." From Mark's reaction it appeared that he appreciated Henry's encouragement, since he nodded his head (yes), and began to research on one of the desktop computers. His research efforts were successful in that he located www.manutd.com, which allowed him to match different fabrics, colors, and sizes to create their uniforms. The website even had an option for Mark to upload the group's logo which could be printed on the uniforms for an additional fee. Finally, when Mark was finished customizing the uniforms, the website calculated the price per uniform and even a discounted price if the uniforms were purchased in bulk. Thus, Henry's encouragement provided feedback to Mark that Henry supported him. This potentially persuaded Mark to engage and persist in the task. Thus, coregulating motivation using praise and encouragement could result in promoting group member's engagement and persistence in tasks.

Overall, the strategy group members used most often to regulate motivation was statements made to express interest in another group member's contributions. For example, Sandy was assigned the process plan of designing the logo for their uniform, and Gabrielle caught sight of it as Sandy was adding the soccer ball to the middle. The logo had two dragons—one coming up each side of a soccer ball. The logo was fitting seeing as the name of their soccer team was The Vampire Dragons. Upon catching a glimpse of the logo, Gabrielle stated, "Our symbol, our symbol is cool, looks like, like a heart shape. I like it, its awesome." Sandy replied, "I know, 'cause we like love soccer and we're called the dragons." In this excerpt, Gabrielle's statement potentially served to sustain Sandy's engagement and persistence in the task. It also conveyed to Sandy that her contribution to the group project was valued. It is possible that if Gabrielle had suggested to Sandy that her drawing was awful, this may have conveyed to Sandy that her work had little value to the group, and as a result Sandy may have ceased participation. Similar to the interpretation for the car group, feedback indicated by a member's level of interest in another group member's work was important because it could influence whether that group member engaged and persisted within that task. As such, when feedback suggested to another group member that his or her contributions were interesting or cool this had the potential to increase participation and persistence in the task. In this example, Gabrielle's statement potentially helped sustain Sandy's engagement and persistence in the task in that she continued to work diligently on the logo design.

Finally, there were three instances in which a group member criticized another group member's contribution in the course of their project. In one instance, Gabrielle and Henry were working to construct their own contract from the example sports contracts Mark found while researching. This was the last week students had to work on their projects, since the final week was devoted entirely to working on their power point presentations. Gabrielle was reading Henry the parts of the original contract that they previously highlighted, and Henry was typing them into a Word document. Gabrielle suggested that they include an additional section on team conduct because in her opinion, "so many players do not act responsibly." Mark, who was not currently working with Henry and Gabrielle on the contract, overheard Gabrielle's idea and stated, "Henry, don't listen to her… *she* (referring to Gabrielle) lacks intelligence." Gabrielle rolled her eyes at Mark as if this statement did not bother her, however, her lack of persistence may have suggested otherwise. That is, instead of elaborating on her idea to include a section on team conduct, she continued to read the next highlighted section on expenses to Henry for him to type. Thus, it is possible that Mark's verbal criticism decreased Gabrielle's persistence and engagement in the task, in that she did not continue to explain and elaborate on her idea after Mark's comment. When strategies used to regulate motivation decreased participation, persistence, or engagement and therefore were potentially ineffective strategies at regulate motivation these were identified as unproductive strategies.

Because a successful group used potentially unproductive strategies to regulate engagement, it begs the question, what then was the affect when group members used unproductive strategies? First, it is important to note that there were only three unproductive statements over the six-week period during which students interacted on a daily basis. As such, the soccer group used productive strategies to regulate motivation much more often than unproductive strategies. Second, it is possible that unproductive strategies have the potential to immediately affect a group member's participation, persistence, or engagement on a particular task, but if this was directed at a single, isolated task, then the affect of the unproductive statement may not influence an individual's participation, persistence, or engagement on future tasks. This was the case in the previous example, in that Mark's statement had an immediate, but not long-term effect on Gabrielle's persistence with the task. Finally, even if a group member disengages from the project completely, it was still possible that the group's end product could still be successful if other group members took over.

It is important to note that verbal criticisms were not necessarily unproductive. In fact, verbal criticisms could potentially be productive strategies if they served to increase a group member's participation, persistence, or engagement in the task. Thus, if a group member (A) criticized another group member (B), and this impelled group member (A) to persist further to demonstrate his (A) capabilities, then the verbal criticism was productive. Thus, it was not possible to classify certain statements as productive or unproductive without considering the context in which they occurred.

Regulating behavior. Table 5.12 provides the number of self- and coregulated instances in which group members regulated behavior over the course of the project.

Table 5.12

Instance of Self- and Coregulated Instances of Behavioral Regulation over Time for the Soccer Group

	Time 1	Time 2	Time 3	Total
Regulating Effort or Attention				
Self-regulated	0	0	0	0
Coregulated	13	12	18	43
Total	13	12	18	43

The soccer group had 43 instances of behavioral regulation over the course of their project. There were 13 instances in time 1, 12 instances in time 2, and 18 instances in time 3. All the instances of behavioral regulation were coregulated in that either a group member regulated another group member's behavior or multiple group members shared in regulating each other's behavior.

Similar to the car group, the soccer group used reminders or directives to engage, reengage, and/or sustain on-task behavior. An example of a coregulated effort to engage a group member in the task occurred on the last day students had to work on completing their projects (note, this does not include the final week they had to design power point presentations). Mark was late to class and then spent the first couple of minutes using the restroom. When he returned he was putting some papers from another class into his backpack. Henry attempted to engage Mark in the project by stating, "Alright, come on man, this is the last day, let's get to work." This resulted in Mark wrapping up and joining the rest of the group who were finalizing their list of players. Thus, Henry coregulated Mark's behavior and this served to promote Mark's engagement in the task.

Similarly, members of the soccer group engaged in coregulated efforts to reengage group members who were off task. For example, in one instance, Sandy was fooling around with the pen tool on her laptop. She had opened a Microsoft Paint document and was using the pen to scribble. Gabrielle, who was supposed to be working with Sandy to determine the cost of cleats, noticed that Sandy was off task and stated, "Sandy! Come over here!" At first, Sandy ignored Gabrielle's attempt to regulate her behavior, but then Gabrielle repeated, "Sandy! Come on! Sandy! Let's go. Come on, Sandy." The second attempt at behavioral regulated was effective and Sandy reengaged in the task.

Finally, a group member used directives and reminders to coregulate another group member's effort or attention in order to sustain on-task behavior. Similar to the car group, these consisted of statements such as, "Alright, go, come on" or "Keep going." The purpose of these statements was to sustain group members' effort or attention in the task. It is important to note, that some coregulated efforts to regulate behavior were intended to limit another group member's effort for a moment. For example, if a group member (A) was going too fast, or going ahead of another group member (B), then group member (B) used behavioral regulation to control group member (A)'s contribution. Statements such as "Wait, wait, wait, wait, wait, wait;" or "Alright, hold up, hold up" were intended to temporarily reduce another group member's (B) effort until group member (A) could catch up. The strategy to reduce effort temporarily was a productive strategy in this case because it sustained group member (B)'s participation in the task by allowing him to catch up.

Finally, members of the soccer group also worked together to coregulate each other's effort and attention as they engaged in process planning. These coregulated efforts were intended to sustain on-task behavior as they planned for the next day. In this instance, for example, multiple group members participated in coregulating each other's effort and attention in the task.

> **Henry –** Gabrielle: Ok. (Henry flips through the binder.)
> **Gabrielle –** Henry: No you don't. I want to plan.
> **Henry –** Gabrielle: Alright. (Passes the binder to Gabrielle)
> **Gabrielle –** Henry: Here you hold the tape. (Passes the tape to Henry)
> **Henry –** Gabrielle: Alright come on pay attention. Right here (Points to the paper) put Mark will research the medical staff. Mark. (calls Mark) *(regulating behavior)*
> **Henry –** Mark: You are going to research the medical staff tomorrow. Is that OK?
> **Mark –** Henry: Yeah
> **Gabrielle –** Henry: Henry, Henry, look, is this right. (Gabrielle reads what she is writing) *(regulating behavior)*
> **Henry –** Gabrielle: Then you can help Mark
> **Mark –** Henry: what is Sandy going to do? Sandy come here, hurry up. What are you going to do tomorrow? *(regulating behavior)*
> **Henry –** Sandy: Do you want to help me with the manager, researching the manager? To Gabrielle: Over here write that.
> **Gabrielle –** Group: Oh! Now I like it!
> **Henry –** Gabrielle: Come on just hurry, come on, hurry up, we need to finish it. *(regulating behavior)*
> **Gabrielle -** Henry: Okaaay!

In this excerpt multiple group members engaged in coregulated attempts to regulate each other's behavior during process planning. First, Henry attempted to focus Gabrielle's attention on the task by stating, "Alright come on pay attention" and Gabrielle then attempted to get Henry's attention by stating, "Henry, Henry, look." Mark also engaged in coregulated attempts to regulate Sandy as well. The purpose of the behavioral regulation was to focus group members' effort and attention in the task, in order to sustain on-task behavior during process planning. When multiple group members assumed responsibility for regulating each other's behavior, it distributed this responsibility among members of the group, not leaving one group member to have to assume responsibilities for these processes alone. Thus, in the soccer group, the group members engaged in two forms of coregulation in order to regulate each other's effort and attention. Coregulating behavior benefited the group by (1) engaging students, (2) reengaging students, and (3) sustaining effort and attention in the task at hand.

The Dinosaur Group

Planning. The third group whose planning was analyzed was the dinosaur group. Table 5.13 presents product planning instances for the dinosaur group over time.

Table 5.13

Number of Product Planning Instances for the Dinosaur Group over Time

Product planning	Time 1	Time 2	Time 3	Total
Idea Generation	7	3	0	10
Question	3	0	0	3
Elaborated	6	1	0	7
Summarized	3	0	0	3
Accepted/ answered question	5	3	0	8
Alternative idea/Reject/ Ignore	9	0	0	9

Total	33	7	0	40

Similar to the car and soccer group, the majority of product planning occurred during the first time period of the project. One exception occurred during time 2 when Cathy suggested a way to arrange the floor plan. She elaborated on this idea, and it was accepted by Jake and Terri. Although the number of product planning instances was slightly greater for Cathy, the dinosaur group was more like the car group in that product planning was more shared among multiple group members. The dinosaur group differed from other groups in that they were more likely to reject and propose alternative project ideas ($N = 9$).

Also similar to the car and soccer groups, product planning in the dinosaur group was coregulated. That is, multiple members shared in proposing project ideas and spent considerable time during time 1 defining, elaborating on, and refining their project ideas. This pattern of product planning was important for the group in that all group members developed a shared understanding of the scope of the project. For example, in this next excerpt, members of the dinosaur group shared in coregulating product planning. This discourse occurred during the first week of the project after students had finished putting together their collaborative collage and just as they were given their “I have a theme, now what” worksheet. Notice how each group member proposed, rejected, and/or redefined various project ideas, and the accepted project idea (i.e., to have one wing) was the result of their shared product planning efforts. I have provided interpretations in italics to direct the reader’s attention to salient parts of the dialogue.

Terri – group: People like it ... *(Terri is referring to the idea of doing a project about dinosaurs)*
Jake – group: I like it. *(Jake agrees that he likes this idea as well)*
Terri – group: So do I.
Jake – group: but okay.
Cathy –group: we could actually do like two ... *(Cathy is referring to an idea to do two models for two of the dinosaurs in their wing)*
Jake – group: Well like two of the exhibits could be on the same floor ..., like, me and Cathy's, me and David's, or me and Terri's, and David's and Cathy's, whatever. *(Jake elaborates on and refines this idea)*
Terri – group: You could just put the whole model of the wing. *(Terri offers an alternative idea)*
Cathy – group: We could do like two each. Like two exhibits and the wing *(Cathy tries to blend both project ideas together)*
Jake – Cathy: Nah (*laughs*). *(Jake rejects this idea)*
Cathy – Jake: Okay you could do one kind and you could do um ....
Terri – Cathy: No we shouldn't do like both cause that's kind of too much. Cause you have to ... *(monitoring)*
Cathy – Terri: No but it's a museum. Museums have to be full of exhibits. There just can't be like four of them. *(elaborates on the idea)*
Jake – Terri: But we are only doing one wing. So we'll have one wing with a lot of exhibits *(elaborates on the project idea)*
Terri – group: yea but like if we only have like 5 weeks then I don't think we can make up that many exhibits. *(monitoring)*
Cathy – Terri: Then what we have to do is like research a little bit of every dinosaur and like only show the exhibit for one ... (*elaborates on the idea*)
Terri – Cathy: Come up with the ... (*pushes hands out on desk*)
Jake – group: Or we research 3-4 dinosaurs each ... *(elaborates on the idea)*
Cathy – group: Ok, but only do one floor plan for the whole wing *(summarizes the idea)*

This excerpt illustrates the shared product planning that the dinosaur group engaged in to define the scope of their project. The project idea to build a model of the entire wing was a result of all group members sharing in the product planning process. As such, this discourse reflected the second form of coregulation in which group members shared in product planning simultaneously on a joint task, rather than a situation in which one group member coregulated product planning processes for the group. Specifically, all members proposed, elaborated on, refined, and summarized project ideas. As was the case in the car group, because each group member participated in product planning, this potentially led to a shared understanding among group members of the scope of their project. Furthermore, when group member have assumed a role in developing project ideas, they may be more likely to participate in process planning efforts to carry out those project ideas.

Turning now to process planning in the dinosaur group, Tables 5.14 provides the number of instances of process planning by members of the dinosaur group over the course of their project.

Table 5.14

Number of Process Planning Activities for Dinosaur Group over Time

Process Planning	Time 1	Time 2	Time 3	Total
Self-	1	11	6	18
Coregulated	32	22	12	66
Total	33	33	18	84

The dinosaur group's total instances of process planning was 84, which was similar in amount to the soccer group's total number of instances of process planning (N = 78). Also similar to the previous groups, the majority of process planning was coregulated, that is, either one person assigned tasks to the other group members or all group members shared in assigning tasks to each other simultaneously. Alternatively, the dinosaur group differed from the previous groups in that there were notably more verbalized instances of self-regulated process planning for this group over the course of their project.

Recall that I also collected evidence of students' process planning in their group binders. The dinosaur group recorded their process planning 96% of the time. Of the total amount of instances in which students' recorded their process planning, these records were specific 54% of the time. As discussed earlier with the car and soccer group, the specificity of the group's plans may have potentially affected how efficient they were in carrying out previously developed process plans during the next class period.

To reiterate, the dinosaur group engaged in both product and process planning over the course of their project. In the dinosaur group product planning was similar to the car group in that multiple group members shared in coregulating product planning. That is, multiple group members proposed project ideas, elaborated on project ideas, offered alternative ideas, and summarized project ideas, which potentially led to a shared understanding among group members of the scope of their project. Furthermore, because multiple group members assumed a role in developing project ideas it may explain why they all participated in process planning efforts to carry out those project ideas.

Monitoring. Table 5.15 provides the monitoring processes that the dinosaur group used to regulate their projects.

Table 5.15

Monitoring Processes for Dinosaur Group over Time

	Time 1	Time 2	Time 3	Total
Task Monitoring				
Self-	0	3	4	7
Other	12	15	7	34
Total	12	18	11	41
Content Monitoring				
Self-	13	27	17	57

Other	29	34	20	83
Total	42	61	37	140
Monitoring				
Understanding				
Self-	1	0	2	3
Other	0	0	0	0
Total	1	0	2	3
Total	55	79	50	184

Overall, the dinosaur group engaged in 184 instances of monitoring processes over the course of the project. The majority of monitoring occurred in time 2, and then decreased in time 3. Of the total number of monitoring processes, 41 instances related to task monitoring. The majority of instances in which group members engaged in task monitoring were coregulated. These instances reflected a more Vygotskian approach to coregulation in that one group member monitored another group member's assigned task. There was no instance where group members shared in monitoring each other’s assigned duties. Instances of group members task monitoring remained relatively consistent over the three time periods which suggested the group members were involved in monitoring each other’s work equally over the course of the project. For example, during time 1 the group members established a task through process planning to divide the number of dinosaurs they included in their project (*N* = 12) and each group member researched three dinosaurs for the final project. After Cathy and Terri had finished their research, Cathy monitored Jake’s task, “Did you finish the Mamenchisaurus?, What other two do you have?” Jake answered her and responded that he was still working on them. Here, Cathy’s monitoring benefited the group in that it reminded Jake that he was in charge of researching these dinosaurs, and it ensured that someone researched the dinosaurs and therefore accomplished the assigned tasks. Furthermore, in the process she also learned that he was also in charge of researching the Stegosaurus and Elaphrosaurus so she could account for those as well.

Coregulating task monitoring played an important role in how the dinosaur group regulated their project. In general, the group as a whole benefited from its members checking that everyone was doing what they were assigned. By ensuring that everyone fulfilled the task assigned to them during process planning it increased the likelihood that all parts of the project were completed, and provided an opportunity for group members to revise process planning if a particular group member did not fulfill his assigned role. I did not observe any instances when group members shared in task monitoring together.

There were also instances where individuals self-regulated task monitoring. For example, there was an instance during time 2 close to the end of the period when Terri finished up a research page on the Brachiosaurus. She noted to herself, “Next I gotta’ design the kid’s activity.” At first this appeared to be Terri engaging in process planning but as I revisited the group binder, I found that this was an explicit task she assigned to herself previously. Thus, Terri was self-monitoring by keeping herself on-task with the group’s process planning. Similarly, Jake monitored his own process planning when he said to himself, “All I need is Elaphrosaurus and then I’m done.” There were seven instances of self-regulated task monitoring over the course of the project.

Referring back to Table 5.15, the quantitative data suggested that members of the dinosaur group made statements related to content monitoring 140 times over the course of the project. Similar to the car and soccer groups, content monitoring was greatest during time 2, which was not surprising since this was when group members were generating ideas and gathering information related to their project. Thus there was more for them to monitor. There were both self-regulated and coregulated forms of content monitoring used in the dinosaur group.

First, group members engaged in a number of instances of self-regulated content monitoring. There were 52 instances of self-regulated content monitoring over the course of the project and the majority of instances occurred during time 2. At one point during time 2, the group members worked on figuring out the dimensions of the floor plan when Jake stated that, “Ok, so one mile equals twenty blocks. And one block is 264 ft, so…” The purpose of this statement was for Jake to self-monitor his problem-solving as he attempted to figure out the length of one side of the museum. The benefit of self-monitoring to Jake was that he explicitly walked himself step by step through the process. Jake could have also benefited from explicit self-monitoring because by making his thought process explicit he made his thinking visible to the other group members who in turn could have provided feedback.

This group also engaged in coregulated content monitoring. One type of coregulated content monitoring that the group engaged in was when one group member monitored another group member’s ideas, research, or problem-solving. An example of this type of monitoring occurred when the group members were researching the various dinosaurs they had been assigned. Cathy monitored what research Jake had found on the

Elaphrosaurus. She stated, “Ask Jake what he found about the Elaphrosaurus. Jake… what does it say about the Elaphrosaurus.” Jake responded by explaining to Cathy that the Elaphrosaurus lived in Tanzania and North America and was a carnivore. Cathy interrupted Jake, “Do you have its length and width?” Here Cathy coregulated content monitoring by checking in on what Jake had found in his research and making sure he included the information that they would need later to construct their floor plan.

This group also engaged in content monitoring in which all group members shared in monitoring research gathered related to the task together. In this next excerpt, Cathy calculated the dimensions of the wing. David and Terri were supposed to transfer these dimensions to the poster board, but before doing so David examined Cathy’s calculations. By monitoring her work, he recognized that the calculation did not make sense. Terri also monitored this process by asking Cathy if she was sure that her calculation was correct. Thus, this example serves to illustrate how group members share in content monitoring related to their projects.

David – Terri: Four by eleven? *(David monitors the initial value from Cathy)*
Terri – David: Uh huh.
David – Terri: Are you crazy?
Terri – David: That’s what she said and I think it’s puny but…
David – Terri: If I were to lay down in that, I wouldn’t fit. I’m almost five feet. (*Monitoring)*
Terri – Cathy: Hey are you sure it’s four feet? *(Terri monitors Cathy’s* problem-solving*)*
David – Cathy: ‘Cause if I were to lay down in it then I wouldn’t fit. *(David elaborates on this monitoring)*
Jake – David: Yeah, but what if Shaq comes, what if Shaq comes to the museum.
Terri – Cathy: Are you sure? *(monitoring)*
Catherin – Terri: Hold on, I have to look at it again *(Cathy self-monitors)*
Terri – Cathy: you gotta do it again *(process planning)*-- you messed up somewhere

Thus, in this excerpt group members shared in content monitoring processes simultaneously. What resulted (i.e., the identification of an error and new process planning to recalculate the wing dimensions) was a product of David and Terri monitoring Cathy's calculation. Sharing monitoring activities benefited this group in several ways. First, more than one group member was involved in monitoring processes, which led to a greater number of individuals using their own knowledge to examine each other's work. Because there were more individuals weighing in and checking on Cathy's calculation, not only did Terri and David benefit from increased practice regulating, but the quality of the project also increased as a result of the feedback. Cathy also benefited from the shared monitoring in that an error in her work was identified; thus, she realized that she needed to make changes to her problem-solving. Therefore, monitoring in this group context led to the identification of an error in a group member's work that resulted in feedback that improved the overall quality of the end product.

This group was similar to the soccer and car groups in that when they engaged in content monitoring, they also identified how each other's ideas, research, and problem-solving related to their project ideas and original goals. This helped to ensure that the group's daily work was relevant and related to the overall project ideas (i.e., to build a floor plan for the museum), and that students were not off task researching information that did not contribute to the final product. Thus, it served to keep the group focused and on-task toward their shared goals. Recall the example of coregulated content monitoring provided above. In that example, Cathy monitored what research Jake found on the Elaphrosaurus. She stated, "Ask Jake what he found about the Elaphrosaurus. Jake… what does it say about the Elaphrosaurus." Jake responded by explaining to Cathy that the Elaphrosaurus lived in Tanzania and North America and was a carnivore. Cathy interrupted Jake by stating, “Do you have its length and width?” When Jake responded that he has only found that the height is 6.5 and the length is 11, Cathy responded, “Whats the width… but we need the width for the floor plan.” It was this explicit effort to not only monitor what another group member were working on, but also how the information or idea related to the group’s goals that was important about the quality of monitoring processes illustrated in this group.

Finally, group members engaged in monitoring understanding. In the dinosaur group, there were only three instances of monitoring understanding that occurred over the course of the project. For example, one instance occurred during time 1 when Cathy explained why she wrote budget on their "I have a theme now what" worksheet the day before. In the middle of her explanation she stated, “We need money, so like we need a budget for money. Wait what I am saying Uh I don’t know, whatever.” In other groups, when students explicitly stated that they did not understand something, it provided an opportunity for others to explain the process to them. In this group, none of the other group members understood how to make a budget for one wing either. Because Cathy could not articulate why making a budget should be one of the group's project ideas, this task was abandoned. In one sense, the identification that group members did not understand the purpose of one of their tasks was beneficial since it led to the refinement of a project idea. In another sense, the group members were quick to discard tasks without engaging in further research or discussion in order to understand the purpose of the budget. It is probably reasonable to assume that because no one in the group understood how to make a budget for one wing this task would have been eventually discarded or ignored.

This group did not engage in any explicit coregulated efforts to monitor understanding. This may imply that group members assumed that they all shared a common understanding of a particular topic. In this group, because they all monitored plans, ideas, and research as they were proposed, perhaps all group members did share a common understanding of their project. Thus, the lack of explicit attempts to monitor understanding did not affect the end product. On the other hand, it could be that some group members' understanding contained inconsistencies and misconceptions, and because one or more of the group member did understand, the effect of some group members holding misconceptions did not affect overall group performance.

To reiterate, the dinosaur group engaged in three types of monitoring, that is, task monitoring, content monitoring, and monitoring for understanding. The majority of monitoring occurred in time 2, and then decreased in time 3. This was similar to the car group in that efforts during time 1 were directed at constructing project ideas and process planning, and group members task monitored these plans during time 2. The majority of instances in which group members monitored process planning were coregulated. These instances reflected a Vygotskian approach to coregulation in that one group member monitored that another group member worked on his or her assigned task. This was similar to both the car and soccer groups in that monitoring process plans in these groups also reflected a Vygotskian approach to coregulated learning. Also similar to these groups, which group member assumed responsibility for coregulating rotated among all group members. In general, the group benefited from its members checking that everyone was doing what they were assigned. By ensuring that everyone fulfilled the part assigned to them in process planning it increased the likelihood that all parts of the project were completed, and provided an opportunity for group members to revise process planning if a particular group member did not fulfill his or her assigned role.

There were both self-regulated and coregulated forms of content monitoring used by the dinosaur group. When content monitoring was coregulated it reflected a Vygotskian approach to coregulation as well as instances in which all group members shared in this process. As a result, this group's content monitoring was similar to the car group's content monitoring processes. Alternatively, this group was similar to both the soccer and car groups in that when they content monitored they also identified how each other's ideas, research, and problem-solving related to their original goals or product plan. It was this explicit effort to not only monitor what another group member was working on, but also how the information or idea related to the group's goals that was important about the quality of monitoring processes illustrated in this group. Finally, the dinosaur group engaged in self-regulated forms of monitoring understanding, but did not engage in any coregulated forms of monitoring understanding.

Evaluation. The dinosaur group also made statements aimed at evaluating both the content and mechanics in their project. Table 5.16 provides the number of instances of evaluation processes that the dinosaur group used to regulate their projects.

Table 5.16

Evaluation Processes for the Dinosaur Group over Time

	Time 1	Time 2	Time 3	Total
Content Evaluation				
Self-	0	0	0	0
Coregulated	0	9	5	14
Total	0	9	5	14
Evaluating Mechanics				
Self-	0	0	0	0
Coregulated	0	6	1	7
Total	0	6	1	7
Total	0	15	6	21

The dinosaur group has 21 instances of evaluation processes over the course of their project. Evaluation took place during times 2 and 3, which was a similar trend found in both the car and soccer groups. Therefore, there seems to be some support for the idea that on a complex task that occurred over an extended period of time, students engaged in evaluation activities toward the end of the project's given time period. This hypothesis is reflected in the current environment because during times 2 and 3 students began to pull their research efforts together to construct their end products (i.e., in this case a floor plan of their new wing).

In the dinosaur group, the group members evaluated the content of each other's work 14 times over the course of their project. For example, Terri was working on the knowledge web related to determining what information goes in a floor plan. Cathy took Terri's paper and looked it over. In doing so she stated, "This is wrong… you need to put down doors and windows." As a result, Terri added the information to her knowledge web. This evaluation helped Terri to identify an error in her work, and as a result of Cathy's evaluation being specific, Terri knew exactly how to correct her error. There were several benefits that resulted from Cathy evaluating Terri's work. Cathy benefited from practicing evaluation processes, which over time could result in improvements to her evaluation processes. Moreover, by evaluating Terri's work Cathy was kept abreast to what another group member was working on. Alternatively, Terri may have benefited from receiving feedback on her work in that it led to corrections that improved the overall quality of the project. Unlike the soccer group, the role of evaluator was assumed by multiple members of the group throughout the project.

Turning to how students evaluated the mechanics in their project, there were seven instances of coregulated efforts to evaluate each other's spelling, grammar, and punctuation. An example of this type of coregulated behavior occurred when Jake attempted to spell "definition." David evaluated his work, "No, it's D, E…DEFINITION." The benefit of coregulating for Jake was that he received feedback on his work, which he in turn used to correct his error. This resulted in a better quality product. There were no instances when group members self-regulated evaluation processes, nor were there instances where coregulation of grammatical errors was shared among the group members simultaneously on a joint task.

To reiterate, the dinosaur group evaluated both the content information in their project, as well as spelling, grammar, and punctuation in each other's work. Evaluation processes were similar to the soccer group in that there were no explicit self-regulated efforts by group members to evaluate their own work, and that the majority of evaluation processes were coregulated. Coregulation resembled a Vygotskian approach in that one group member evaluated another group member's work. Unlike the soccer group however, the responsibility for evaluating was assumed at one point or another by all group members. In general, group members benefited more when coregulated evaluations were specific, but the overall quality of the product was improved regardless because the feedback was accurate.

Regulating motivation. Table 5.17 provides the number of instances in which members of the dinosaur group used each strategy to regulate motivation over the course of their project.

Table 5.17

Instances of Strategies the Dinosaur Group Used to Regulate Motivation over Time

	Time 1	Time 2	Time 3	Total
Praise or encouragement	0	0	4	4
Agreement or understanding	0	0	0	0
Self-efficacy talk	0	0	0	0
Relevance	0	0	0	0
Interesting/ cool	4	5	0	9
Performance (extrinsic)	0	0	2	2
Negative self-efficacy	0	0	0	0
Verbal put down	1	1	1	3
Total	7	6	7	18

The dinosaur group had 18 statements aimed at regulating motivation over the course of their project. In general, the number of motivational statements were consistent over time, with seven statement made during time 1, six statements made during time 2, and seven statements made during time 3.

There were nine instances of statements made to express how interesting or cool an aspect of the task was. For example, in one instance Cathy found a virtual tour of the dinosaur wing at the Museum of Natural History, and was looking through it on her computer. Terri was sitting next to her filling out a knowledge web on the floor plan, when she noticed what Cathy was looking at and stated, “What is that?” Cathy replied, “It’s a virtual tour” at which Terri commented, “That is so cool, we can use this” This statement potentially helped to sustain Cathy’s persistence in the task in that she continued to look through the website. Had Terri indicated that the information on the website was not interesting, perhaps Cathy would have discontinued her actions. Furthermore, Terri’s statement reaffirmed Cathy’s participation in the group, because she signified that the activity Cathy was working on was valued. Thus, statements made by members of the dinosaur group to convey interest had a similar affect as when these statements were made by members of the car and soccer groups.

Another strategy group members in the dinosaur group used to regulate motivation was to make a reference to their grade. For example, in one instance Jake was off task browsing the Internet looking for the final score of yesterday’s basketball game. David observed Jake’s behavior and stated, “Come on… we are gonna’ fail…you gotta’… finish this report on (*looked at Jake’s paper)*… Elaphrosaurus.” Jake closed the computer screen and continued working on his report. Thus, this statement served to regulate Jake's motivation in that it potentially reengaged Jake in the task by suggesting that they would fail if he did not finish his work. Over the course of the project, David attempted to regulate motivation twice by making reference to grades. At one point he explained to his group members that, if he failed this class, then he would be expelled and sent back to his neighborhood school. This may explain why it was particularly important to him that the group succeed and why he referenced grades as a strategy to motivate his fellow group member's engagement.

Group members' use of praise and encouragement to regulate motivation was another strategy used by the dinosaur group. Using praise and encouragement to regulate motivation had a similar affect in the dinosaur group that it had in the car and soccer groups. That is, when a group member praised another group members efforts (e.g., when Jake told David, "Man that's awesome! You're workin' now) it potentially served to increase persistence and motivation, and encourage continued participation in the task. Thus, in the dinosaur group, statements made about how interesting something was, references to grades, and the use of praise/encouragement were productive strategies the group used to regulate motivation because these strategies increased participation, persistence, and/or motivation in the task.

There were also three instances in the dinosaur group when a group member made statements to another group member that could be considered a verbal put down. One of these instances occurred when Cathy and Terri were working on figuring out the dimensions for their wing based off of the initial calculations Jake made previously. Cathy was asking Terri a lot of questions about how she determined certain measurements. Eventually, Terri became frustrated with Cathy's questions and let out a loud sigh. David overheard this and stated, “Does she annoy you or something?” at which Terri replied, “Yes, she does…very much.” This hurt Cathy’s feelings and she put her papers in the binder and walked over to the desktop computers on the other side of the room where she remained for the rest of the period. While I could not read the computer screen to determine if she was researching information related to the project or off task, it was clear that Terri’s statement discouraged Cathy’s participation and persistence in the task. Terri apologized to Cathy at the end of the period, and all the group members’ worked on determining the measurements for their floor plan the following day. Thus, the verbal put down did not appear to have a long-term negative effect on Cathy’s engagement or the group members’ future interactions.

Regulating behavior. Table 5.18 provides the number of self- and coregulated instances in which the group regulated behavior over the course of the project.

Table 5.18

Instance of Self- and Coregulated Instances of Behavioral Regulation over Time for the Dinosaur Group

	Time 1	Time 2	Time 3	Total
Regulating Effort or Attention				
Self-regulated	0	0	1	1
Coregulated	22	15	10	47
Total	22	15	11	48

The dinosaur group had 48 instances of overt statements aimed at coregulating each other’s effort or attention in tasks. There were 22 instances in time 1, 15 instances in time

2, and 11 instances in time 3. All the instances of behavioral regulation were coregulated in that either a group member regulated another group member's behavior or multiple group members shared in regulating each other's behavior.

Similar to the car and soccer groups, the dinosaur group used reminders or directives to engage, reengage, and/or sustain on-task behavior. For example, in one instance, the group was working to complete their collaborative collage which was due the end of the class period. In an attempt to sustain engagement in the task, Jake stated, "Guys, we have like five minutes to finish this, so let's go!" The statement was intended to use time (i.e., time left in the period) as a strategy for regulating effort. Jake made this statement in order to regulate group members' behavior and sustain their on-task behavior. However, the affect of Jake's statement on the group's behavior was not clear. Whereas in other examples it was easy to observe the affect group member's statements had on behavior (i.e., because behavior changed in some meaningful way as a result of the statement), here group members' behavior remained the same as it was before the statement was made (i.e., they are on-task). I provided this example in order to illustrate that just because a group member attempted to sustain on-task behavior did not guarantee that it resulted in any overt changes in task engagement. On the other hand, the statement did not decrease or interfere with on-task behavior, so the attempt to regulate behavior did not harm the group in any way.

There were instances of behavioral regulation in the dinosaur group in which group members used reminders or directives to engage or reengage another group member in the task, and the results of coregulation were more overtly noticeable. For example, while the group members were working independently to research dinosaurs, David was observed tapping his pencil on the desk and singing to himself. This went on for a couple minutes until Terri stated, “Work! Come on…seriously… you need to get this done.” Even though David continued to sing to himself, he began researching the Sinraptor dinosaur. Thus, Terri’s coregulated attempt to regulate David’s behavior resulted in reengaging David in the task.

Similar to the soccer group, members of the dinosaur group engaged in coregulated efforts to regulate behavior that were intended to limit another group member’s effort for a moment. For example, when Cathy and Terri were working together to determine the dimension of their wing, Cathy used phrases such as, “Hold on a second” and “Wait, hold on” to temporarily control Terri’s effort until Cathy was able to process the information.

> **Terri –** Cathy: Yeah. Like this part right here. (Terri shows her with her finger) That’s one thousand, one thousand…
> **Cathy –** Terri: Wait, hold on. *(regulating behavior)* Do you mean, wait is this the museum? Like this is block from my perspective. *(monitoring)*
> **Terri –** Cathy: That’s four blocks.
> **Cathy –** Terri: Ok, so that’s the whole thing? *(monitoring)*
> **Terri –** Cathy: Yeah *(monitoring)* that’s the whole side of it which is four blocks… (Points to the paper).
> **Cathy –** Terri: Ok hold on a second. *(regulating behavior)* So this part where it’s lined up, that’s the, that’s where the museum starts right?
> **Terri –** Cathy: Yeah *(monitoring)*, that is the fourth floor.

In this excerpt Cathy coregulated Terri’s effort using phrases such as, “Wait, hold on” and “Ok, hold on a second.” The benefit of regulating behavior in this way was that it created an opportunity for Cathy to ask questions and for Terri to provide explanations. It also allowed both group members to self- and coregulate monitoring processes by controlling the conversation so that monitoring could occur.

The Fashion Group

Planning. Finally, I analyzed the fashion group. Recall, that this group had a low final project assessment grade. As such, I was interested in learning if and how their planning processes differed from other groups who were successful on their projects. Table 5.19 presents the number of product planning instances for the fashion group over time.

Table 5.19

Number of Product Planning Instances for the Fashion Group over Time

Product planning	Time 1	Time 2	Time 3	Total
Idea Generation	2	4	2	7
Question	0	4	1	5
Elaborated	0	1	0	1
Summarized	0	0	0	0
Accepted/ answered Q	1	1	1	3
Alternative idea/Reject/ Ignore	0	1	0	1
Total	3	11	4	18

The fashion group had 18 instances of product planning. Not only was this significantly lower than the other groups, but 88% of their product planning occurred during times 2 and 3 of the project. *When* students product planned may be one indication of why this group's project was unsuccessful. It could be that low instances of generating project ideas in time 1, and higher instances of project ideas in times 2 and 3, potentially indicated that by the time they defined the scope of their project, the project deadline was too close for them to carry out any new project ideas successfully.

There were also differences in the subprocesses the fashion group engaged in during product planning compared to the other groups. For instance, while members of the car and dinosaur groups shared in coregulating product planning by proposing project ideas, elaborating on project ideas, offering alternative ideas, and summarizing project ideas, in the fashion group these subprocesses were not used. For example, there were project ideas offered during time 1 by Britney who suggested that they make a fashion line and showcase their clothes on a website. These ideas were explicitly accepted by Diane, and implicitly accepted by Gerry and Breanne in that they did not object to these proposed ideas. The second example of product planning did not occur until week 6. This discussion was initiated by Britney who asked a series of questions related to what the group members intended to put on their website. Diane proposed a new project idea, that is, to make a catalogue instead, and she elaborated on what they would put in the catalogue. When Britney further questioned this project idea, Diane responded, “No, this is what we will do because there is no time left to do a website.” Gerry agreed and the group moved forward with the proposed project idea to make a catalogue.

Thus when project ideas were proposed, they were not refined. This differed from the car and dinosaur groups who engaged in explicit processes to refine their projects ideas early on. Similarly, in the soccer group although project ideas were not refined by multiple group members, Henry assumed responsibility for elaborating and summarizing project ideas, thereby refining project ideas for the group. Because he engaged in this process in front of his group members, (1) they had a clear understanding of the scope of the project, and (2) project ideas were more developed as a result of the refinement process. Alternatively, in the fashion group, project ideas were proposed and accepted without developing them enough for group members to have a clear understanding of the scope of the project. Therefore, the failure of this group to clearly define and refine project ideas early on may have potentially contributed to their low performance on their project.

Turning now to process planning in the fashion group, Table 5.20 indicates the total number of instances in which group members engaged in process planning over the course of their project.

Table 5.20

Number of Process Planning Activities for Fashion Group over Time

Process Planning	Time 1	Time 2	Time 3	Total
Self-	8	10	3	21
Coregulated	31	21	12	64
Total	39	31	15	85

The fashion group engaged in 85 process planning instances which was similar to the dinosaur (N = 84) and soccer (N = 78) groups. 45% of these statements were made during time 1, while 36% were made during time 2, and 19% during time 3. Overall the majority of process planning was coregulated in that either one group member coregulated process planning for the other group members, or multiple group members shared in coregulating process planning simultaneously. Finally, the fashion group was similar to the dinosaur group in that group members engaged in instances of self-regulated process planning.

Recall that I also collected evidence of students' process planning in their group binders. Of the total number of days students could possibly process plan, the fashion group process planned 76% of the time. Thus, compared with other groups, the fashion group was less likely to record process planning in their binders. I also investigated how specific students' records of their process planning were as another indication of the quality of their planning. For the fashion group, their records of process planning were specific 36% of the time. Thus, the binder data corroborated earlier findings that the fashion group (1) engaged in less recorded process planning instances, and (2) the record of their process planning was less specific than other groups.

The result of the fashion group's unrefined product planning was that even attempts at process planning did not lead to a better overall project. This is because students were assigned to tasks (e.g., Britney researches skirts) without a clear understanding of how the task fit into the overall scope of their project. For example, for two weeks Breanne and Britney researched different styles of accessories; however, they did this with little understanding of how this information would be used by Gerry to design the clothes. That is, low instances of product planning in time one resulted in ill-defined project ideas. Whereas other groups refined their project ideas during time 1, this group engaged in process planning very early. In essence, when they process planned either (1) the group failed to ask themselves how these tasks related to the project idea or (2) alternatively, students performed tasks related to project ideas, but because ideas were broad, and vaguely defined, it made all tasks seemingly relevant. This could potentially account for high instances of process planning in time 1, and could also explain why high instances of process planning does not necessarily denote project success.

Monitoring. Table 5.21 provides the monitoring processes that the fashion group used to regulate their projects.

Table 5.21

Monitoring Processes for Fashion Group over Time

	Time 1	Time 2	Time 3	Total
Task Monitoring				
Self-	2	0	0	2
Other	3	1	0	4
Total	5	1	0	6
Content Monitoring				
Self-	13	5	10	28
Other	24	11	7	52
Total	37	16	17	70
Monitoring Understanding				
Self-	5	1	2	8
Other	0	0	0	0
Total	5	1	2	8
Total	47	18	19	84

Overall, the fashion group had 84 instances of monitoring processes over the course of the project. The majority of these instances occurred in time 1 and then fewer instances occurred in times 2 and 3. Comparing the total number of monitoring instances by the fashion group to the other three groups suggested that they engaged in less monitoring of their project compared to the other groups. That being said, fewer monitoring instances may not necessarily explain this group's low performance on their end product.

Turning to task monitoring, there were six instances in which group members engaged in task monitoring over the course of the project and the majority of these instances occurred in time one. One of these instances occurred when Britney asked Diane, "Did you figure out our name?" This task (i.e., choosing a name) was assigned to Diane while the group was still constructing their collaborative collage. While I did not observe any efforts by Diane to research different names during this time, when Britney task monitored, Diane responded by stating, "J'adore La Mode." The group members accepted Diane's suggestion and moved on.

There were few attempts by the group members to task monitor for the remainder of the project. Instead they (1) engaged in process planning, (2) failed to task monitor whether tasks were completed and then (3) engaged in *new* process planning to either reassign existing tasks or assign new tasks. One possible explanation for why this occurred was because the group members were constantly off task over the course of their project. For example, at the start of one period Gerry process planned, "I'll design the sketches and stuff, and we can all do the advertisements like we will do different ones." Then the group spent the majority of the period discussing what Diane's boyfriend was going to get her for Valentine's Day. At the end of the period when the group began to plan for the next day, Gerry stated, "I think we should research um… high fashion." Neither Gerry nor the other group members task monitored that Gerry was supposed to design clothes. Instead the task assignments from the first instance of process planning were discarded. This trend was typical in this group, and was potentially a result of limited task monitoring.

Alternatively, there were two instances when Britney monitored her own process planning during time 1. One instance occurred when Diane attempted to assign Britney to make photocopies for the teacher. She responded to this with, “I know but I am supposed to be researching accessories with Breanne.” Unfortunately, Diane was persistent so Britney ended up postponing her research to make photocopies.

Failure to task monitor may have contributed to the group's overall poor performance on their project. This was because group members did not check to make sure that other group members completed the tasks assigned to them. This led to duplication of process planning in that group members were constantly process planning and the task assignments that resulted were either partly completed or totally ignored.

There were 70 instances of content monitoring over the course of the project by the fashion group, which suggested that group members did make an effort to monitor their own and each other’s idea, research, and problem-solving. There were 28 instances of self-regulated content monitoring, and 52 instances of coregulated content monitoring over the course of their project. For example, one instance of self-regulated content monitoring occurred when Britney researched different types of sunglasses. She engaged in the following self-monitoring talk as she wrote information down on one of the research pages, “Ok, so there is different types of sunglasses…they need to have UV *(Britney writes on paper).* What else? Oh, they need to be stylish.” Here self-monitoring served as a way for Britney to self-check her research related to the project, and make sure that she did not duplicate something she already had. Self-monitoring also benefited Britney by helping her keep on-task and focused on her research.

There were also instances when group members coregulated content monitoring. In this group content monitoring reflected a Vygotskian approach to coregulation in that one group member coregulated another group member's content monitoring. There were no instances, however, when group members shared in content monitoring simultaneously. There were 52 instances of coregulated content monitoring over the course of the project, and the majority of these instances occurred in time 1. This may have suggested that while group members started content monitoring each other’s ideas, research, and problem-solving, they failed to continue coregulating content monitoring as the project continued. The decrease in instances of content monitoring may have affected the quality of their finished project since group members were not monitoring each other’s work. As such, there were few checks in place to monitor each other’s ideas, research, and problem-solving and so there was less feedback on the quality of each member’s contributions to the end product. There were many examples of this throughout this group’s video data. For instance, Breanne spent over two weeks researching accessories for the group. An examination of her research showed that she recorded that there were many different types of accessories; however, she did not indicate what those different types of accessories were. Because no one monitored Breanne's research, when Gerry began to design accessories during time three (product planning), Breanne’s research was not helpful to her. As a result, Gerry designed few accessories for their product line. As such, when group members failed to coregulate content monitoring this may have had significant implications to their end product. In addition, the failure to continue coregulated content monitoring during times 2 and 3 meant that group members were virtually unaware of each other's research. This resulted in Gerry designing shirts based on her own research of different styles of shirts without realizing that Britney had also researched shirts. Coregulated task monitoring in the car, soccer, and dinosaur groups resulted in group members establishing a shared understanding of the different pieces of their project, whereas in the fashion group this was never achieved.

Perhaps even more significant was that even when group members engaged in coregulated content monitoring, they did not explicitly connect how this research would contribute to their overall project and its goals. For example, during time one Diane asked Britney what she found in her research on high fashion. Britney explained that "Dolce and Gabbana mix things together…see this skirt has like stripes and plaid, so like it's a mix." However, Diane or Britney did not explain how this information would be used in their projects. In other words they did not make the connection that if their company was to reflect the trends in high fashion then they would need to combine different styles together when designing their clothes. So even though the group did engage in efforts to coregulate content monitoring, because they did not also state how the research would connect to their goals, this resulted in many pieces of disconnected research. Thus, when the group constructed their catalogue during time 3 they had pieces of research that were not relevant and as such did not contribute to their end product in any meaningful way.

Finally, the group had eight instances of self-regulation in which a group member monitored his or her own understanding. One instance of self-regulated monitoring understanding occurred during time 1 when Diane tried to understand the purpose of the calendar section in their binder. She monitored her understanding of the calendar section by stating,

> "Alright, so this is a calendar. So, we have to like every day, we have to know what we're gonna do the next day cause today, you know, we're gonna do tomorrow. We're gonna work on it tomorrow. Alright I get it. So those are the daily things to do. Once we're done with making this (*Points to the paper*) we pass like the daily like today's Thursday. Ok, I get this now."

In this excerpt Diane engaged in monitoring mainly for the purpose of clarifying her own understanding of the calendar function and her monitoring led her to greater understanding of the calendar function. Moreover, explicit attempts to monitor understanding exposed her thinking processes to other members of the group who could have then also monitored her understanding. As such, if inconsistencies or misunderstandings were present, fellow group members could have provided feedback to clarify the group members' understanding. The other group members, however, did not paying attention to Diane during this excerpt, and so they did not coregulate monitoring her understanding of the calendar function.

Thus, the fashion group's monitoring processes differed quantitatively and qualitatively from the previous groups. First, they engaged in fewer instances of monitoring over the course of their project. Also the majority of monitoring instances occurred in time 1, which may suggest that even though they began the project monitoring these processes did not continue. Overall, the instances of task monitoring (both self and coregulated) were low over the course of the project. Alternatively, there were self-regulated and coregulated forms of content monitoring by the group members. When content monitoring was coregulated, it reflected a Vygotskian approach to coregulation in that one group member coregulated content monitoring for another individual. That being said, even when group members did engage in coregulated content monitoring, they did not explicitly connect how the research would contribute to their final project. This resulted in many disconnected pieces of research and a failure to establish a shared understanding of how the pieces of their project combined to form the final product. Finally, there were several instances in which group members self-monitored their own understanding, but no instances of coregulated efforts to do so.

Evaluation. Table 5.22 provides the number of instances of evaluation processes that the fashion group used to regulate their projects.

Table 5.22

Evaluation Processes for the Fashion Group over Time

	Time 1	Time 2	Time 3	Total
Content Evaluation				
Self-	0	0	0	0
Coregulated	0	0	1	1
Total	0	0	1	1
Evaluating Mechanics				
Self-	0	0	0	0
Coregulated	0	0	4	4
Total	0	0	4	4
Total	0	0	5	5

The fashion group had fewer evaluation statements overall compared with the other groups (N = 5). All of these statements occurred in time 3 of the project and involved coregulated forms of evaluation. Thus, in all groups students were more likely to coregulate evaluation processes during the later part of their project. There was only one instance where a group member engaged in coregulated efforts to evaluate the content in another group member's work. This occurred when Diane was constructing the power point presentation for the group's project. Britney was reading over her shoulder and stated, "You messed up." Diane probed further by stating, "Where ?," at which point Britney responded, "This should say how we came up with a topic we all liked." This evaluation benefited Diane in that Britney identified an error in her work and explained how she could correct it. Furthermore, the evaluation helped to improve the overall quality of the project, since Diane would have began the power point with knowledge webs had Britney not monitored and evaluated her work.

Compared to content evaluations, there were relatively more instances of evaluation of formatting, spelling, grammar, and punctuation by members of the fashion group ($N = 4$) — although both were low compared to the other groups. These instances reflected a Vygotskian approach to coregulation in that one group member evaluated the mechanics in another group member's work. One of these instances occurred when Gerry was looking over the initial catalogue layout Diane had designed. She stated, "Can I change it… it looks packed." In this example, Gerry was referring to correcting the format of the layout. However, instead of working with Diane to make the corrections, she took over responsibility for readjusting the layout of the document. While perhaps there was little for Diane to learn from Gerry in this particular instance, Gerry' vague evaluation definitely did not benefit Diane in any way, since it was not clear what aspects of formatting needed to be corrected.

Thus, in the fashion group it was more likely for individuals to work independently on the various parts of their project. These individual contributions were never self-evaluated (at least overtly) and very rarely evaluated by fellow group members over the course of the project. Similar to the failure to monitor, because the fashion group did not evaluate their own or each other's work, it may have led to a greater number of errors in their work, and overall a lower quality project.

Regulating motivation. Table 5.23 provides the number of instances in which members of the fashion group used each strategy to regulate motivation over the course of their project.

Table 5.23

Instances of Strategies the Fashion Group Used to Regulate Motivation over Time

	Time 1	Time 2	Time 3	Total
Praise or encouragement	1	1	1	3
Agreement or understanding	2	0	0	2
Self-efficacy talk	0	0	0	0
Relevance	0	0	0	0
Interesting/ cool	1	3	1	5
Performance (extrinsic)	0	0	0	0
Negative self-efficacy	0	0	1	1
Verbal put down	3	1	1	5
Total	7	4	4	16

The fashion group had 16 instances in which they used various strategies to regulate motivation over the course of their project. The majority of these statements were made in time 1 and then decreased over times 2 and 3.

The difference between the fashion group and the other three groups was not in the type or quantity of strategies they used to regulate motivation; rather, it was that these strategies were directed primarily (nine out of the sixteen instances) at increasing the motivation of one group member, Breanne, who showed low interest in the task, and rarely participated in the project. When she did participate it was only after explicit probing by one of the other group members. The other group members tried a number of strategies to increase Breanne's engagement in the task, many of which were similar to the strategies other groups used to regulate motivation. Some of these strategies were forms of positive reinforcement like praise and encouragement while other times they attempted to regulate her motivation by using a verbal put down. Unlike the other groups, however, none of these strategies worked to increase Breanne participation or motivation in the task.

For instance, in one example during time 1, the group members were engaged in process planning group roles for the next day. Gerry announced that she would do a knowledge web on researching high fashion, and Diane asked Britney if she would work with Gerry. Then Diane asked Breanne what she would like to work on. She attempted to encourage Breanne's participation in the discussion by saying, "Come on… Breanne, what do *you* want to do?" This was not successful because Breanne remained silent and stared at Diane. Gerry attempted to coregulate process planning by suggesting that Breanne could work on the knowledge web for the budget. However, Diane was not content with Breanne's lack of participation and interrupted Gerry by saying to Breanne, "Why are you so quiet, it bothers me. Like I feel like slapping you and saying talk." However, this was not successful either. Diane attempted one more time to motivate Breanne by stating, "Ahh, come on talk," but this is also unsuccessful and Gerry interjected, "Just let her work on the budget."

Thus, strategies to coregulate Breanne's motivation were unproductive as they did not increase her participation, persistence, or engagement in the task. One potential explanation for why these strategies were unproductive in coregulating Breanne's motivation could have had to do with the tone in which Diane regulated Breanne. For example, Diane first attempted to coregulate Breanne by stating, "Come on… Breanne, what do *you* think?" This statement had a critical tone that Breanne potentially interpreted as attacking. If this was the case, it could explain why Breanne did not engage in the task. The second time Diane attempted to regulate Breanne's motivation she criticized her by stating, "Why are you so quiet, it bothers me. Like I feel like slapping you and saying talk." This tone was clearly negative, critical, and disrespectful. It did not serve the intended effect of engaging Breanne in the task, and instead potentially undermined any future attempts to encourage her to participate in the group. This observation was supported by the fact that there were few instances when Breanne participated in group discussions over the course of the project. In fact, the only meaningful contribution she had was researching accessories which she did independently.

Finally, members of the fashion group made statements to express interest in another group member's contributions. As previously noted, these statements were important because they had the potential to increase a group member's persistence and engagement in the task. In the other three groups this was the strategy group members used most often to coregulate motivation. Alternatively, however, members of the fashion group used this strategy five times over the course of their projects. In one instance, Britney suggested that they make their own fashion line because they all like fashion. Diane accepted this proposed idea, "Oh, yeah that would be cool! Alright let's do that." Similar to the interpretation for the other groups, feedback indicated by a member's level of interest in another group member's work was important because it could determine if that group member engaged and persisted within that task. In this example, Diane's statement potentially helped sustain Britney's engagement and persistence in the task in that this became the group's primary idea for their project. As such, when members of the fashion group provided feedback that suggested to another group member that his or her contributions were interesting or cool, this had a similar affect on persistence and engagement as it did in the other groups.

Regulating behavior. Table 5.24 provides the number of self- and coregulated instances in which the group regulated behavior over the course of the project.

Table 5.24

Instance of Self- and Coregulated Instances of Behavioral Regulation over Time

	Time 1	Time 2	Time 3	Total
Regulating Effort or Attention				
Self-regulated	0	0	0	0
Coregulated	3	21	28	52
Total	3	21	28	52

The fashion group had 52 instances of behavioral regulation over the course of their project. There were three instances in time 1, twenty-one instances in time 2, and twenty-eight instances of behavioral regulation in time 3. The fashion group was similar to the other groups in that their instances of behavioral regulation increased over the course of the project. However, what was particularly interesting about the fashion group was the degree to which behavioral regulation increased over time. Alternatively, the instances of behavioral regulation were more equally spaced over the three time periods in the other three groups. This may be attributed to the fact that as the project deadline drew closer and the fashion group had yet to agree on well-defined project ideas they engaged in more behavioral regulation strategies to increase each other's effort and attention in the project.

The fashion group was similar to the previous groups in that they used reminders or directives to regulate each other’s behavior. The majority of these instances were attempts to reengage group members in the task. For instance, in time 1, the group members were working on filling out their “I have a theme, now what?” worksheet when they became off task talking about a friend of Britney’s who was reprimanded during lunch. Diane and Gerry were very interested in what happened and proceeded to ask Britney a series of questions. This conversation lasted for almost fifteen minutes until Britney said, “Ok, come on, we really gotta get back to this stuff.” Britney’s comment served to behaviorally regulate the group members back on-task. Unfortunately, it was almost the end of the period so there was not much time left for them to accomplish anything substantial. Alternatively, there were also coregulated efforts to regulate behavior that were directed at sustaining group members' on-task behavior. These were statements like, "Come on" or "Keep going" that served to manage group members' effort at persisting in the task, though these occurred less often than efforts to engage and reengage students in the task. Similarly, there were instances when group members called each other by name or used statements like, "hello" to direct and focus attention on the task.

Summary of Self- and Coregulation Processes by Groups

Planning Processes

In general there are several overarching findings that have resulted from this analysis of groups' planning processes. First, while product planning was a coregulated process in all the groups, differences existed in both the type of coregulation that group members used, and the quality of their coregulated processes. Second, group members engaged in process planning over the course of their projects, and there were differences in the quantity of their process planning over time. Finally, examining the quantity and quality of students' process planning in their binders helped to corroborate findings from the video data.

Total instances of product planning for the car, soccer, dinosaur, and fashion group was 27, 38, 40, and 18, respectively. While the car, soccer, and dinosaur groups engaged in the majority of product planning during time 1, the fashion group product planned most often during times 2 and 3 of the project. Establishing a well-defined plan early on was characteristic of the three successful groups.

Differences also existed in the type of coregulated product planning group members used to define the scope of their project. The car and dinosaur groups coregulated product planning by having all group members share in these processes together. Specifically, in these groups, group members shared in defining the scope of their project, and spent considerable time during time 1 refining their project ideas. This process was important for these groups in that it resulted in group members developing a shared understanding of the scope of their projects. Another equally effective form of coregulation adopted by the soccer group entailed one, more highly regulated individual, product planning for the other members of his group. Henry also refined and summarized project ideas in front of his group members, which meant (1) they had a clear understanding of the scope of the project, and (2) project ideas were more developed as a result of the refinement process. Both types of coregulation were effective in that they potentially (1) increased intersubjectivity and the development of a shared goal among the group members, and (2) led all group members to participate in process planning efforts to carry out proposed project ideas.

This type of effective coregulated product planning was contrasted by analyzing product planning in the fashion group. In the fashion group, project ideas were proposed and accepted without developing them enough for group members to have a clear understanding of the scope of the project. The result of ill-defined project ideas was that when the group process planned, either (1) they failed to ask themselves how these tasks related to the project idea or (2) alternatively, they performed tasks related to project ideas, but because ideas were broad and vaguely defined it made *all* tasks seem relevant. This could potentially account for high instances of process planning in time 1, and could also explain why high instances of process planning did not denote project success.

All groups engaged in process planning over the course of each of their projects. Quantitatively, the fashion group had the largest number of process planning instances (N = 85), while the car group had the least number of process planning instances over the course of their project (N = 63). The majority of process planning by all groups was coregulated. This consisted of either one group member process planning for other group members, or several group members shared in process planning. Qualitatively, there were little differences between the groups in terms of their process planning. In general, all groups engaged in self- and coregulated process planning in order to assign group roles and determine the order in which they would engage in tasks.

Finally, an analysis of the group's record of process planning in their binder was used to triangulate findings from the video data. Specifically, group differences were noted in both the percentage of days students planned, and how specific their plans were. The fashion group process planned in their binder the least number of days (76%) while the car and dinosaur group planned the most (96%). In general groups varied in how specific their process planning was, which ranged from 36% for the fashion group to 82% for the soccer group. The specificity of the group's process planning may have positively affected their efficiency in carrying out previously developed process plans during the next class period.

M*onitoring Processes*

In general there were several overarching findings that have resulted from this analysis of groups' monitoring processes. First, group members engaged in task monitoring over the course of their projects, and there were differences in the quantity of their task monitoring over time. Second, while all groups coregulated content monitoring throughout their projects, differences existed in both the type of coregulation that group members used, and the quality of their coregulated processes. Finally, differences existed in both the quantity and quality of students monitoring understanding instances among the groups. I discuss each of these findings next.

First, groups differed in the number of instances of task monitoring over the course of their projects. The soccer group engaged in the most instances task monitoring (N = 41), with the car and dinosaur group close behind (N = 38 and 33, respectively). The fashion group only had six instances of task monitoring. When task monitoring was coregulated, it reflected a Vygotskian approach to coregulation in that one group member monitored another group member's tasks. This role rotated among the group members in each group; thus, no individual was responsible for monitoring the other group members' assigned duties.

Task monitoring played an important role in how the group members regulated their project. For the person doing the monitoring, she or he benefited from being able to practice monitoring processes, which over time may lead to the refinement of these processes. Here, because all group members monitored fellow group members at various points throughout the project, they all had practice refining their monitoring skills. Alternatively, for the individual being monitored, monitoring served to refocus attention back on-task and maintain on-task behavior. The group as a whole also benefited from its members checking that everyone was doing what they were assigned. By ensuring that everyone fulfilled the part assigned to them, they increased the likelihood that all parts of the project would be completed. They also provided an opportunity for group members to revise the process planning if a particular group member did not fulfill his or her assigned role.

Second, all groups engaged in some form of coregulated content monitoring over the course of the project. All groups had instances of coregulated content monitoring that reflected a Vygotskian approach, while only members in the car and dinosaur group shared in coregulating content monitoring simultaneously. Overall, there were fewer instances of coregulated content monitoring by the fashion group compared to the other three groups. As such, there were fewer checks in place to monitor each other’s ideas, research, and problem-solving, and so there was less feedback on the quality of each member’s contributions to the end product. When members of the dinosaur and car groups shared in content monitoring this benefited these groups in several ways. First, each group member was involved in monitoring processes, which led to a greater number of individuals using their own knowledge and experience to examine each other’s ideas and research. Because there were more individuals weighing in and checking on each other’s ideas and research related to the project, not only did everyone benefit from increased and shared knowledge of the topic, but the quality of the project also increased as a result of the feedback. Second, sharing in monitoring processes also led to greater understanding for all group members. By monitoring each other’s research and ideas, it pressed students to expand on and refine their original understanding and this resulted in feedback that improved the overall quality of the project.

Also members of the car, soccer, and dinosaur group made explicit efforts to monitor how group members’ ideas and research related to the overall goals of the project. This helped to ensure that the group’s daily work was relevant to and related to the overall product ideas and goals (i.e., to build a floor plan for the museum), and that students were not off task researching information that did not contribute to the final product. Thus, it served to keep the group focused and on-task toward their shared goals. The fashion group, on the other hand, did not engage in explicit efforts to monitor how their research connected to the overall goals of their project. This resulted in research that was piecemeal and disconnected, which meant that the group spent considerable time researching aspects that did not contribute to their project.

Finally, there were differences in how students monitored understanding over the course of their projects. The soccer and car groups engaged in both self-regulated and coregulated efforts to monitor understanding, whereas the dinosaur and fashion group only engaged in self-regulated forms of monitoring understanding. The benefit of students making explicit statements about their own understanding when they were working in the group was that it made their thinking visible, which provided opportunities for fellow group members to potentially provide explanations and feedback. When group members engaged in coregulated efforts to monitor understanding, this helped to ensure that all group members shared a common understanding of material related to their projects. Perhaps the reason that some groups were successful even though they did not engage in explicit efforts to monitor understanding was that these processes were more important to some groups more than others. For example, the car group established a shared product plan early on. Thus, monitoring understanding may have been less important to this group than the fashion group who failed to come to a shared definition of the scope of their project. Unfortunately, because of the interrelatedness of various regulation processes used by the groups, I could not distinguish the affects of monitoring understanding alone on the success of the overall project.

Evaluation Processes

In general there were several overarching findings that resulted from this analysis of the groups' evaluation processes. First, while, overall, there were fewer instances of evaluation statements made by all groups compared to their planning and monitoring statements, there remained quantitative differences in amount of evaluation in which groups engaged. Second, all groups engaged in coregulated efforts to evaluate each other's work; however, the car group was the only group to engage in coregulated evaluation that was shared among the group members simultaneously. Third, coregulation in the dinosaur, soccer, and fashion groups reflected a Vygotskian approach in that one group member evaluated the content and mechanics of another group member's work. Finally, evaluations that included specific explanations were hypothesized to benefit the individual being evaluated more than vague evaluations. I will discuss each of these findings next.

In all groups, group members engaged in evaluation of their own or each other's contributions less often than other regulatory processes such as planning and monitoring. The car and dinosaur groups had an equal number of evaluation instances ($N = 21$), whereas the soccer group had 13 instances, and the fashion group had 5 instances. Therefore, the fashion group engaged in the least number of evaluation statements over the course of their project. In all groups, evaluations were made during times 2 and 3 of their projects. This trend made sense in that toward the end of their projects, students combined information to form their final project, and as a result there was project content available for them to assess and correct.

Second, the car group was the only group to engage in the second form of coregulation in which group members shared in evaluating a product simultaneously. In this instance, members of the car group made content- and mechanics- related evaluations. There were several benefits to the group members when they shared in evaluating processes together. First, because multiple group members were involved in evaluation processes it resulted in a greater number of individuals using their own knowledge and experience to assess and correct each other's work. This made it more likely that errors would be identified because more group members were checking for them. Also, when multiple group members shared in evaluation processes, they built on and refined each other's evaluations which in the case of the car group resulted in feedback that improved the overall quality of their final project.

Third, all groups engaged in coregulated efforts to evaluate each other's work that involved one individual evaluating another group member's work. However, there were group differences in who assumed this responsibly in the group. For example, in the car and dinosaur groups, all group members engaged in coregulated efforts to evaluate each other's work. In contrast, Henry assumed responsibility for evaluating his fellow group member's work in the soccer group. There were several potential benefits that resulted from group members evaluating each other work. First, the evaluator benefited from practicing various evaluation processes, which over time, may result in improvements in his or her SRL evaluation processes. Moreover, by evaluating another group member's work, the evaluator was kept abreast to what other group members were working on, thus helping to cultivate shared understanding of the various parts of the project. Finally, the person being evaluated benefited from receiving feedback on their work, which may lead to feedback that would improve the overall quality of the product. In the soccer group, the dilemma when only one group member assumed responsibility for all other group members' work was that (a) he or she might overlook an error, (b) he or she might provide incorrect feedback that no one else evaluates, and/or (c) he or she might not provide an explanation for the correction, and as such the group member would not learn from his or her mistake.

Finally, the data suggested that students benefited from evaluations that were specific. When evaluations were specific, the evaluator (1) identified the error in the student’s work, and (2) explained how to correct it. Thus the person being evaluated potentially had the opportunity to learn from his or her mistake.

Regulating Motivation Processes

Students engaged in a variety of strategies to regulate motivation in their groups. In this research I only observed Vygotskian forms of coregulation in which one group member regulated another group member’s motivation. In general, the car ($N = 19$), dinosaur ($N = 18$), and fashion groups ($N = 16$) had a relatively equal number of instances of coregulating motivation over the course of their projects. The soccer group had a greater number of instances of coregulating motivation ($N = 38$)

One common strategy that members in all groups used to regulate motivation was to make statements to express interest in another group member’s contributions. As previously noted, these statements were important because they had the potential to increase a group member’s persistence and engagement in the task. Group members also used praise/encouragement to motivate each other’s participation and persistence in a task. While using praise/encouragement was a productive strategy to regulate motivation in the soccer group, in the fashion group it had the opposite effect. Thus, it was not possible to classify certain statements of praise/encouragement as productive or unproductive without considering the context in which they occurred. Finally, group members in the soccer, dinosaur, and fashion groups attempted to regulate motivation through verbal put downs. While verbal put downs could immediately affect a group member’s participation, persistence, or engagement on a particular task, these statements did not appear to affect long-term participation, persistence, or engagement on future tasks.

Behavioral Regulation Processes

There are several important findings that have resulted from the analysis of the groups' behavioral regulation. First, groups differed in the total number of instances of behavioral regulation, and this pattern was different over time across groups. While behavioral regulation for the car, soccer, and dinosaur groups was more equally distributed across all three time periods, in the fashion group there were fewer instances of behavioral regulation in time 1, and then many instances in times 2 and 3. Second, groups mainly used coregulated attempts to regulate each other’s behavior, and both types of coregulation were observed. Coregulating behavior benefited the group by (1) engaging students, (2) reengaging students, and (3) sustaining effort and attention in the task at hand. Third, all groups’ coregulated attempts to regulate each other’s effort and/or attention were in the form of directives or reminders that served to engage, reengage, or sustain engagement in a task. Note that not all forms of behavioral regulation were intended to increase effort or attention. On the contrary, some coregulated efforts to regulate behavior were intended to temporarily reduce another group member (B)'s effort until group member (A) could catch up or understand a particular concept. Thus, to summarize, although there were quantitative group differences in the use of coregulated behavioral regulation over time, I did not observe any meaningful between group distinctions in how group members regulated each other's effort and/or attention in the task. Instead, all groups were similar in that they used short directives or reminders to regulate each other's effort or attention in the task over the course of their projects.

Relationships among Coregulatory Processes

To this point, I have examined how groups coregulated aspects of their cognition, motivation, and behavior as separate processes within the group context. However, in reality these processes co-occurred and have reciprocal relationships with one another. While I have alluded to these relationships in the examples I have highlighted thus far, this section focuses exclusively on investigating the co-occurance and interplay among these processes. To do so, I will investigate here the relationship among processes group members used to regulate cognition, motivation, and behavior. Note, this research acknowledges that there may be various relationships among coregulated learning processes. However, I will only discuss those that I directly observed in the data.

Planning and Monitoring

In my investigation of students' planning, I found that group members engaged in product and process planning in order to define the scope and organize their projects. It is important to note the relationship between product and process planning, as the two processes were inextricably linked. In general, product planning led to the formation of project ideas, which were refined, accepted, rejected, and/or ignored (see Figure 5.0), though the degree and time period in which groups refined and accepted ideas varied among groups. When project ideas were accepted students engaged in process planning in which they determined tasks to carry out their project ideas, and assigned group members to those tasks. For example, in the excerpt on page 144 the car group's product planning led to process planning, "Ok, so cut vehicles, cut out any sports car vehicles." In addition, group members also monitored their process planning; that is, they monitored the status of the tasks they created through process planning (i.e., task monitoring). Here, monitoring led to the revision, refinement, and/or clarification of existing tasks and project ideas, which in turn led to renewed product and/or process planning. For example, in one instance Nate was assigned during process planning the task of determining what kind of metal they should use for their car. Adam coregulated task monitoring stating, "Did you find the metal stuff?" at which Nate replied that he was currently researching that information. Adam further coregulated content monitoring, "What does it say? (referring to a website Nate is looking at)" at which Nate replied, "It talks about different metals and stuff but it doesn't really say like what metals are best." Adam evaluated the information on the website with Nate and conferred Nate's original assessment that the information was not helpful to their project. This resulted in process planning in which Nate stated, "maybe we could try the library and see if there are books there we can use. I could ask her if we can go." Thus, coregulated efforts to task monitor led to new process planning. A similar relationship was noted between content monitoring and the revision of product and process planning. Thus, there were reciprocal relationships between planning and monitoring processes, in that instances of product and process planning led to monitoring of these processes, and task and content monitoring processes led to the revision of existing product and process planning, or new product and process planning.

Monitoring and Evaluation

Monitoring and evaluation processes co-occurred as group members worked jointly on aspects of their project. For example, in the excerpt provided on page 160, the car group shared in coregulating assessing and correcting their company's mission statement. In this excerpt there were examples in which students' coregulated monitoring processes, and those in which they coregulated evaluation processes. For example, Adam coregulated monitoring Rick's contribution stating, "Yeah, this doesn't make any sense." In the same excerpt, Nate both coregulated monitoring and evaluation processes stating, "Fossil fuel is still being used? (monitoring) No. (evaluation)." Thus monitoring and evaluation processes were not independent; instead, they potentially co-occurred as students engaged in the task.

Regulating Cognition and Motivation

Coregulated attempts to regulate cognition and motivation also co-occurred within the collaborative context. This was particularly evident between regulating motivation and product planning. That is, there were many instances in which group members used motivational strategies to sustain other group members' engagement, while they proposed and refined project ideas. For example, in the excerpt on page 163, Rick regulated Adam's motivation by expressing interest in Adam's project idea. Specifically, Adam engaged in product planning where he proposed a project idea to use multiple batteries at various points throughout the car so that the vehicle could hold more than enough energy to operate. Rick regulated Adam's motivation stating, "Yeah, that could be so cool." This was followed by additional product planning in which Adam elaborated on his idea and described where in the car the batteries would be positioned. As such, coregulated instances of regulating motivation and cognition were intertwined throughout group members' discourse and these processes co-occurred within the group context.

Regulating Cognition and Behavior

Finally, within the collaborative context there were coregulated attempts to regulate both cognition and behavior. First, group members made statements aimed at regulating each other's behavior in order to sustain effort and/or attention while product or process planning. For example, in one instance the car group was product planning how their car would hold enough energy to power the car. During this process, the group members engaged in several attempts to focus each other's attention on the task. Thus, efforts to regulate behavior facilitated product planning in that it directed and sustained group member's attention on their product planning. Moreover, efforts to regulate behavior also resulted in new product and process planning. For example, in one instance Rick coregulated Adam's effort by suggesting that he "come on" and read more about how solar energy would power their car. After coregulating Adam's behavior, Rick engaged in process planning and assigned himself the task of reading as well. Thus, group members' discourse contained instances of regulating behavior and cognition concurrently.

Quantitative Self-Report Data for these Groups

Research question 4 asked, for the groups analyzed in question 3, how consistent are students' reports of their self- and coregulation processes with their observed regulation processes? To answer this question I relied on students' self-reported data from the surveys from the quantitative analysis (referred to as "self-reported") and video data of students' collaborative interactions from the qualitative analysis (referred to as "observed"). Table 5.25 presents the self-reported data for the car, soccer, dinosaur, and fashion groups of their self-regulated learning at time 1 and time 3, as well as their coregulated learning at time 2. Recall that students responded to survey statements based on a four-point scale where the number indicated the degree to which the student believed he or she did what the item described. Choices included always (4), most of the time (3), some of the time (2), or never (1).

Table 5.25

Self-reported Self- and Coregulated Learning Scores from the Car, Soccer, Dinosaur, and Fashion Groups

	SRL Time 1	Coregulated Learning Time 2	SRL Time 3
Car Group		3.13	
Adam	3.27		3.67
Barry	3.03		3.33
Rick	3.33		3.40
Nate	3.80		4.00
Soccer Group		2.85	
Gabrielle	1.93		2.27
Mark	2.77		3.13
Sandy	2.80		2.73

Henry	3.30		3.47
Dinosaur Group		3.08	
Cathy	3.13		3.47
Terri	3.13		3.07
Jake	2.83		3.20
David	2.87		3.13
Fashion Group		3.01	
Diane	2.20		3.53
Britney	2.67		3.33
Breanne	2.60		2.67
Gerry	1.87		2.87
Grand Mean (for all 16 groups)	2.73	2.99	3.04

The Car Group

Table 5.25 presented each group member's SRL scores and the group's coregulated learning score from the self-reported questionnaires. For students in the car group, each group members' self-reported time 1 self-regulated learning was above the average of the entire sample (X = 2.73), and their self-reported SRL increased over the course of their project. Moreover, the car groups' self-reported coregulated learning (3.13) was also higher than the sample mean (X = 2.99). Thus, these findings were consistent with the patterns observed in the qualitative analysis, in that members of the car group appeared to have high degrees of self-regulated learning and the group engaged in effective coregulated learning as well.

Examining student's self-reported and observed data jointly may lead to a greater understanding of how students used self- and coregulated learning processes to regulate cognition, motivation, and behavior in their project. For instance, the self-reported data suggested that members of the car group had high SRL (time 1) before the start of their projects, and their self-reported SRL increased over the course of their project. Alternatively, the qualitative analysis suggested that students engaged in few verbalized instances of self-regulated planning, monitoring, evaluation, or behavioral regulation processes over the course of their project. No group member in any of the four groups self-regulated their motivation.

Using the information from students' self-reported data may help to explain why members of the car group had few explicit self-regulated learning statements. Research has found that as students learned/ refined newly learned skills they engaged in more overt verbalizations of their thinking processes in order to facilitate this process (Webb et al., 1995). Over time and with continued practice, these skills became automatized rendering them implicit and unavailable for observation. It is possible then that the reason I did not observe many explicit verbalizations of the car group member's SRL might be due to the fact since these were highly self-regulated learners to begin with, these processes were already automated and thus implicit. The car group's self-reported coregulated learning score was 3.13, which was higher than the average coregulated learning score for all groups (X = 2.99). This was consistent with the qualitative data, in that I observed many instances in which members of the car group coregulated each other's cognition, motivation, and behavior. The high instances of coregulated learning may potentially help explain the relatively low instances of self-regulated learning observed for this group. For example, perhaps highly effective coregulating learning lessened the need for large amounts of explicit self-regulated learning. While this may be possible, it is more likely that students engaged in SRL processes, but these processes were not verbalized, because I observed many instances of students researching and problem-solving independently, and some degree of self-regulated learning would have been needed to do this effectively. Furthermore, the finding that students' SRL increased over the course of the project suggested that students were practicing and refining these skills.

The Soccer Group

An examination of the self-reported data for members of the soccer group illustrated that Henry had the highest time 1 SRL score, 3.30, compared to the other members of his group (1.93, 2.77, and 2.80). Furthermore, self-reported SRL increased for Henry, Mark, and Gabrielle over the course of their project, while Sandy's SRL score decreased slightly. Finally, the group's coregulated learning score was 2.85, which was below the grand mean CRL score for all sixteen groups.

First, Henry's high SRL time 1 score corroborated qualitative findings that Henry served as this group's MRO, and as such assumed responsibility for coregulating his other group members' cognition, motivation, and behavior. Similarly, the fact that the other three members had relatively low time 1 SRL further substantiated this conclusion. From the qualitative analysis, recall there were few self-regulated attempts at product or process planning, but greater self-regulated attempts at task and content monitoring for members of the soccer group. It is possible that the reason I did not observe many self-regulated attempts at product and process planning may be because the presence of a highly self-regulated learner in the group may have reduced the need for other members to self-regulate, in part because regulation processes were coregulated by Henry.

Henry's coregulated product and process planning led to well-defined project ideas and the assignment of tasks to group members during time 1. It is possible that these coregulated efforts may have scaffolded the other group members' self-regulation in that Henry defined the scope of the task and assigned them group roles. Once this initial framework for the project was defined, it may have reduced the complexity of the task enough for all group members to begin contributing to self- and coregulated task and content monitoring processes. This may explain the increase in self-regulated task and content monitoring in time 2. As such, coregulated product and process planning did not lead to increases in self-regulated planning in this project. However, coregulated efforts may have scaffolded students enough to support them as they began using self-regulation processes during time 2.

Thus, while the literature has theorized that coregulated learning in a specific regulatory area (e.g., planning) will lead to the internalization of planning strategies, and as a result the learner will begin to self-regulate planning activities independently, these data suggested that coregulating in a specific area may have additional benefits in that it could lead to the development of self-regulation in other areas. The increase in Henry, Mark, and Gabrielle's SRL suggested that students were using SRL processes over the course of this project, and this was consistent with the qualitative data. It is important to note that although Sandy's self-reported SRL score decreased slightly from time 1e to time 3, I did not observe any evidence that her actual SRL decreased over the course of the project. Because this decrease was minimal, it is possible that it could be attributed to random measurement error.

Finally, the group's coregulated learning score was lower (2.85) than the total sample average (X = 2.99). This finding was inconsistent with results from the qualitative analysis that suggested members of the soccer group coregulated aspects of each other's cognition, motivation, and behavior. One possibility for this finding is that students in the soccer group were not skilled at calibrating coregulated learning processes. Another possibility is that because this score was an average of each group member's self-reported perceptions of the group's coregulated learning, if there was one low score then this score would decrease the average score for the entire group. Last, using the qualitative analysis to interpret this finding recall that coregulation reflected a Vygotskian approach, in which one group member coregulated another group member's cognition, motivation, and behavior. Keeping this in mind I examined a statement on the CRL survey, "In our group we looked over each other's work to see if we understood what each member was doing." As it is currently worded, this statement measured the type of regulation in which (1) the MRO rotated among group members or (2) multiple group members shared in coregulation processes. It does not, however, assess the type of coregulation that occurred in the soccer group. As such, because Henry assumed responsibility of MRO on most tasks, it is conceivable why the other group members' perceptions of coregulated learning would be relatively low since in their group the type of coregulation used did not correspond to the forms that the survey items measured.

The Dinosaur Group

The self-report data from the quantitative analysis suggested that students in the dinosaur group had relatively average levels of SRL at time 1, compared to the other groups. Similar to the soccer group, three of the four group members' SRL scores increased from time 1 to time 3, while one group member's SRL slightly decreased over this period. Finally, the group's coregulated learning score was 3.08, which was higher than the grand sample mean for all sixteen groups ($X = 2.99$).

Findings from the qualitative data suggested that members of the dinosaur group engaged in a number of verbalized self-regulation and coregulation processes over the course of their projects. When students have average SRL, this may suggest that their SRL processes were not advanced enough for them to be automatized and therefore implicit. Furthermore, in this group, one group member did not assume the role of MRO on all tasks. From the literature, it has been hypothesized that as students learned/ refined newly learned skills they engaged in more overt verbalizations of their thinking processes in order to facilitate this process (Webb et al., 1995). Therefore, it is possible that because the dinosaur group's SRL were not advanced enough to be automatized, or were their self-regulated learning processes managed by a MRO, that this explained why there were more explicit verbalizations of SRL observed in this group.

Finally, students' self-reported coregulation scores were consistent with observed instances from the qualitative data. That is, members of the dinosaur group engaged in various forms of coregulation in order to regulate each other's cognition, motivation, and behavior. Unlike the soccer group, they were more likely to share coregulation processes among multiple group members simultaneously or the role of MRO alternated among various members of the group.

The Fashion Group

Results from the quantitative self-report data suggested that students' time 1 SRL scores were lower (2.20, 2.67, 2.60, 1.87) than the average time 1 SRL score for all sixteen groups (X = 2.99). There were substantial increases in SRL from time 1 to time 3, and two of the four students' time 3 SRL scores were above the grand sample mean score for all students (3.04). Finally, students self-reported coregulated learning score (3.01) was slightly higher than the sample mean (2.99) for all sixteen groups.

First, there was a substantial increase in self-reported SRL scores for members of the fashion group over time. From the qualitative data, there was some evidence to corroborate this finding in that members of the fashion group had instances of self-regulated process planning (N = 21) and also instances of SR content monitoring (N = 28). Furthermore, students' self-reported coregulation scores were slightly higher (3.03) than the overall coregulation mean score for all groups (2.99). This was also consistent with qualitative findings that suggested members of the fashion group engaged in efforts to coregulated cognition, motivation, and behavior. Given these findings, it is necessary to examine the quality of students' self- and coregulation instances in order to understand why the fashion group was not successful on their overall project.

There are several possible explanations for these findings. First, it is possible that students were not effective at calibrating their self- and coregulation, and thus the quantitative self-report data were biased. Because the qualitative data, in general, substantiated the self-report data, I do not hypothesize that was the case here. Second, recall that in the fashion group, project ideas were proposed and accepted without developing them enough for group members to have a clear understanding of the scope of the project. The result of ill-defined project ideas was that when the group process planned, either (1) they failed to ask themselves how these tasks related to the project idea or (2) alternatively, they performed tasks related to project ideas, but because ideas were broad, and vaguely defined, it made all tasks seem relevant. This could potentially account for observed instances of SRL process planning, and could also explain why instances of SRL process planning did not necessarily denote project success.

Thus, these data suggested effective product planning and task monitoring were essential to the group's success. Efforts to self-regulate process planning did not benefit the group because there were few attempts to task monitor ($N = 6$). Furthermore, even though group members engaged in self-regulated content monitoring this did not benefit the group because group members did not link the information they found during research to their product planning goals. As such, in the group context, these data suggested coregulation and self-regulation were intertwined and highly related, and groups needed to engage in both effective self- and coregulation in their projects for them to be successful. That is, self-regulation alone was not enough— effective coregulation was needed as well to promote success.

To reiterate, the car, soccer, and dinosaur groups engaged in both effective self- and coregulation in their projects. In general, the information from group members' self-reported data was corroborated by information from the qualitative analysis. This suggested that students' calibrations of their SRL and CRL were relatively high. The benefit of using mixed methodologies to examine SRL and CRL in these groups was that

(1) the quantitative analysis provided insight into students' perceptions of their SRL and CRL which I could not conclude from observation alone, while (2) the qualitative data provided insight into the quality of students' SRL and CRL which was not apparent from the quantitative data. Thus, using mixed methodologies led to a deeper understanding of how group members self- and coregulated cognition, motivation, and behavior in their projects. For the fashion group, using mixed methodologies was needed in order to understand the group's regulation processes. Using the quantitative data alone, it would have been difficult to understand how group members could have above average self-reported SRL and CRL, but a low overall performance score. Using the qualitative data allowed a deeper investigation into the quality of their self- and coregulation processes. Therefore, even if students' calibrations of their SRL and CRL processes were high, mixed methods were still needed in order to interpret these findings.

Summary of the Qualitative Results Section

To analyze the qualitative data in my research project I relied on three main data sources: (1) the verbal transcripts of video data of students working on their collaborative projects, (2) information derived from students' group binders, and (3) students' self-reported survey responses. These data were used to answer research question number three (i.e., What self- and coregulated learning processes do students use to regulate cognition, motivation, and behavior); and research question 4 (i.e., For the groups analyzed in question 3, how consistent are students' reports of their SRL processes and coregulation processes with their observed regulation processes?) These analyses led to three general findings: (1) there were both within-group and between-group differences in the number of instances in which groups self- and coregulated cognition, motivation, and behavior, and these findings suggested a possible trend over time in regulatory processes in successful groups; (2) successful groups engaged in different, but equally effective forms of coregulation, and this differed from regulation processes in the fashion group; and (3) mixed methodologies allowed for a deeper understanding of how group members self- and coregulated cognition, motivation, and behavior in their projects, which quantitative or qualitative data alone would not have accomplished.

Total instances of product planning for the car, soccer, dinosaur, and fashion group was 27, 38, 40, and 18, respectively. While the car, soccer, and dinosaur groups engaged in the majority of product planning during time 1, the fashion group product planned most often during times 2 and 3 of the project. Furthermore, all groups engaged in process planning over the course of each of their projects. Quantitatively, the fashion group had the largest number of process planning instances ($N = 85$), while the car group had the least number of process planning instances over the course of their project ($N = 63$). Thus, establishing well-defined project ideas during product planning, and then engaging in process planning targeted to assign group roles and determine the order of tasks was the trend that was characteristic of successful groups. Alternatively, in the fashion group project ideas were proposed and accepted without developing them enough for group members to have a clear understanding of the scope of the project. The result of ill-defined project ideas was that when the group process planned, either (1) they failed to ask themselves how these tasks related to the project idea or (2) alternatively, they performed tasks related to project ideas, but because ideas were broad, and vaguely defined, it made all tasks seem relevant. This could potentially account for observed instances of SRL process planning, and could also explain why instances of SRL process planning did not necessarily denote project success.

Examining monitoring processes, groups differed in the number of instances of task monitoring over the course of their projects. The soccer group engaged in the most instances task monitoring ($N = 41$), with the car and dinosaur group close behind with 38 and 33, respectively. The fashion group had only six instances of task monitoring. Alternatively, the car, soccer, dinosaur and fashion groups made statements related to content monitoring 74, 158, 140, and 70 times over the course of their projects. In the car and dinosaur groups, monitoring instances were highest during time 2, while in the soccer and fashion groups monitoring instances were highest in time 1. The difference between groups may be attributed to when groups finished engaging in the majority of product planning. That is, for the car and dinosaur groups, product planning was longer and monopolized the majority of time 1, which may explain why monitoring processes occurred in time 2. Alternatively, in the soccer and fashion groups, students' engaged in the majority of product planning early in time 1, which may indicate why monitoring began earlier.

Overall, group members engaged in evaluation of their own or each other's contributions less often ($N = 60$) than other regulatory processes such as planning ($N = 432$) and monitoring ($N = 589$). The car and dinosaur groups had an equal number of evaluation instances ($N = 21$), whereas the soccer group had 13 instances, and the fashion group had five instances ($N = 5$). Therefore, the fashion group engaged in the least number of evaluation statements over the course of their project. In all groups, evaluations were made during time 2 and time 3 of their projects. This trend made sense in that toward the end of their projects, students were combining information to form their final project, and as a result there was project content available for them to assess and correct.

Students engaged in a variety of strategies to regulate motivation in their groups. In this research I only observed Vygotskian forms of coregulation in which one group member regulated another group member's motivation. In general, the car (N = 19), dinosaur (N = 18), and fashion groups (N = 16) had a relatively equal number of instances of coregulating motivation over the course of their projects. The soccer group had the greatest number of instances of coregulating motivation (N = 38).

Finally, groups differed in the total number of instances of behavioral regulation, and this pattern was different over time across groups. While behavioral regulation for the car, soccer, and dinosaur groups was more equally distributed across all three time periods, in the fashion group there were fewer instances of behavioral regulation in time one, and then many instances in times 2 and 3.

Thus, for the successful groups the total instances of planning, monitoring, and evaluation had a linear trend over time. This does not mean that this was always the case. Successful groups were also more likely to regulate motivation and behavior (in terms of total instances) more equally over their projects. In contrast, the fashion group differed from the successful groups in that they engaged in the majority of product planning instances and behavioral regulation during times 2 and 3. Moreover, process planning and content monitoring were highest in time 1. Alternatively, this group was similar to the successful groups in that they evaluated during the latter end of their project and in that they used strategies to regulate motivation consistently across the project. In all groups, except for evaluation processes and behavioral regulation processes for the fashion group, all other regulation processes, in general, decreased in time 3. For week 1 in time 3, students were finishing up their projects, but for week 2 in time 3, groups were constructing a power point presentation for their project. The decrease in regulation scores in time 3 may have suggested that there were qualitative differences between when groups were working on their project and when group members constructed their power point. Perhaps for members of these groups, constructing a power point was routine, and thus did not require extensive regulation processes to accomplish.

The second overall finding from the qualitative section was that successful groups engaged in different, but equally effective forms of coregulation, and this differed from regulation processes in the fashion group. The car and dinosaur groups coregulated product planning by having all group members share in these processes together. Specifically, in these groups, group members shared in defining the scope of their project and spent considerable time during time 1 refining their project ideas. This process was important for these groups in that it resulted in group members developing a shared understanding of the scope of their projects. Another equally effective form of coregulation adopted by the soccer group entailed one, more highly regulated individual (Henry) product planning for the other members of his group. Henry also refined and summarized project ideas in front of his group members, which meant (1) they had a clear understanding of the scope of the project, and (2) project ideas were more developed as a result of the refinement process. Both types of coregulation were effective in that they potentially (1) increased intersubjectivity and the development of a shared goal among the group members, (2) led all group members to participate in process planning efforts to carry out project ideas.

This type of effective coregulated product planning was contrasted by analyzing product planning in the fashion group. In the fashion group, project ideas were proposed and accepted without developing them enough for group members to have a clear understanding of the scope of the project. The result of ill-defined project ideas was that when the group process planned, either (1) they failed to ask themselves how these tasks related to the project idea or (2) alternatively, they performed tasks related to project ideas, but because ideas were broad, and vaguely defined, it made all tasks seem relevant. This could potentially account for high instances of process planning in time 1, and could also explain why high instances of process planning do not necessarily denote project success.

In general, in all groups the majority of process planning was coregulated. Qualitatively, there were little differences between the groups in terms of their process planning. In general, all groups engaged in self- and coregulated process planning in order to assign group roles and determine the order in which they would engage in tasks.

When task monitoring was coregulated it reflected a Vygotskian approach to coregulation in that one group member monitored another group member's tasks. This role rotated among the group members in each group, thus no one individual was responsible for monitoring the other group members’ assigned duties. Task monitoring played an important role in how the group members regulated their project. For the person doing the monitoring, she or he benefited from being able to practice monitoring processes, which over time may lead to the refinement of these processes. Here, because all group members monitored fellow group members at various points throughout the project, they all had practice refining their monitoring skills. Alternatively, for the individual who was being monitored, monitoring served to refocus attention back on-task and maintain on-task behavior. The group as a whole also benefited from its members checking that everyone was doing what they were assigned. By ensuring that everyone fulfilled the part assigned to them they increased the likelihood that all parts of the project were completed, and provided an opportunity for group members to revise the process planning if a particular group member did not fulfill his or her assigned role.

All groups engaged in some form of coregulated content monitoring over the course of the project. All groups had instances of coregulated content monitoring that reflected a Vygotskian approach, while only members in the car and dinosaur group shared in coregulating content monitoring simultaneously. Overall, there were fewer instances of coregulated content monitoring by the fashion group compared to the other three groups. As such, there were fewer checks in place to monitor each other's ideas, research, and problem-solving, so there was less feedback on the quality of each member's contributions to the end product. When members of the dinosaur and car groups shared in content monitoring, this benefited these groups in several ways. First, each group member was involved in monitoring processes, which led to a greater number of individuals using their own knowledge and experience to examine each other's ideas and research. Because there were more individuals weighing in and checking on each other's ideas and research related to the project, not only did everyone benefit from increased and shared knowledge of the topic, but the quality of the project also increased as a result of the feedback. Second, sharing in monitoring processes also led to greater understanding for all group members. By monitoring each other's research and ideas, it pressed students to expand on and refine their original understanding, which resulted in feedback that improved the overall quality of the project.

Also, members of the car, soccer, and dinosaur group made explicit efforts to monitor how group members' ideas and research related to the overall goals of the project. This helped to ensure that the group's daily work was relevant to and related to the overall product ideas and goals (i.e., to build a floor plan for the museum), and that students were not off-task researching information that did not contribute to the final product. Thus, it served to keep the group focused and on-task toward their shared goals. The fashion group, on the other hand, did not engage in explicit efforts to monitor how their research connected to the overall goals of their project. This resulted in research that was piecemeal and disconnected, which meant that the group spent considerable time researching aspects that did not contribute to their project.

All groups engaged in coregulated efforts to evaluate each other's work that involved one individual evaluating another group member's work. However, there were group differences in who assumed this responsibly in the group. For example, in the car and dinosaur groups, all group members engaged in coregulated efforts to evaluate each other's work. In contrast, Henry assumed responsibility for evaluating his fellow group members' work in the soccer group. The car group was the only group who engaged in the second form of coregulation in which group members shared in evaluating a product simultaneously. In this instance, members of the car group made content and mechanics related evaluations. There were relatively more instances of evaluation of formatting, spelling, grammar, and punctuation by members of the fashion group ($N = 4$) than content evaluations, although both were low in comparison to the other groups. There are several potential benefits that resulted from group members evaluating each other’s work. First, the evaluator benefited from practicing various evaluation processes, which over time, may result in improvements in his or her SRL evaluation processes. Moreover, by evaluating another group member’s work, the evaluator was kept abreast to what other group member were working on, thus helping to cultivate shared understanding of the various parts of the project. Finally, the person being evaluated benefited from receiving feedback on their work, which may lead to feedback that improved the overall quality of the product. In the soccer group, the dilemma when only one group member assumed responsibility for all other group members' work was that (a) he or she may have overlooked an error, (b) he or she may have provided incorrect feedback and no one else evaluated that feedback, and/or (c) he or she did not provide an explanation for the correction and as such the group member did not learn from his or her mistake.

The data suggested that students benefited from evaluations that were specific. In general, evaluations were specific in the car, soccer, and dinosaur groups. When evaluations were specific, the evaluator (1) identified the error in the student’s work, and (2) explained how to correct it. Thus, the person being evaluated potentially had the opportunity to learn from his or her mistake. Finally, when the evaluator worked with the individual being evaluated to correct his or her mistakes, this also served as an opportunity for the individual to learn from his or her mistake.

One common strategy that members in all groups used to regulate motivation was to make statements to express interest in another group member’s contributions. As previously noted, these statements were important because they had the potential to increase a group member's persistence and engagement in the task. Group members also used praise/encouragement to encourage each other's participation and persistence in a task. While using praise/encouragement as strategy to regulate motivation was a productive strategy in the soccer group, in the fashion group it had the opposite effect. Thus, it was not possible to classify certain statements as productive or unproductive without considering the context in which they occurred. Finally, group members in the soccer, dinosaur, and fashion groups attempted to regulate motivation through verbal put downs. While verbal put downs had the potential to immediately effect a group member's participation, persistence, or engagement on a particular task, these statements did not appear to affect long-term participation, persistence, or engagement on future tasks.

Finally, groups mainly used coregulated attempts to regulate each other's behavior, and both types of coregulation were observed. Coregulating behavior benefited the group by (1) engaging students, (2) reengaging students and, (3) sustaining effort and attention in the task at hand. All group's coregulated attempts to regulate each other's effort and/or attention were in the form of directives or reminders that served to engage, reengage, or sustain engagement in a task. Note that not all forms of behavioral regulation were intended to increase effort or attention. On the contrary, some coregulated efforts to regulate behavior were intended to temporarily reduce another group member (B)'s effort until group member (A) could catch up or understand a particular concept. Thus, to summarize, although there were quantitative group differences in the use of coregulated behavioral regulation over time, I did not observe any meaningful between-group distinctions in how group members regulated each other's effort and/or attention in the task. Instead, all groups were similar in that they used short directives or reminders to regulate each other's effort or attention in the task over the course of their projects.

Thus, successful groups engaged in coregulated product planning to define the scope of their projects, and coregulated process planning to determine group roles and the order of tasks. Because the soccer group was equally as successful on the project as the car and dinosaur groups, there was no current evidence to suggest one form of coregulation was better than the other. Alternatively, it was more important that the group refined project ideas as they engaged in product planning. Moreover, successful groups coregulated both task and content monitoring to ensure process planning tasks were accomplished, and group members were aware of each other's research. In addition, these groups made explicit efforts to monitor how group members' ideas and research related to the overall goals of the project. Thus, it served to keep the group focused and on-task toward their shared goals. In terms of evaluation processes, successful groups engaged at least equal amounts of content and mechanics evaluation processes. Moreover, all three successful groups engaged in Vygotskian coregulated evaluation processes, while the car group was the only group to share in evaluation processes together. The successful groups were also more likely to engage in productive motivational strategies, in that these strategies increased participation, persistence, and engagement. When group members used potentially unproductive strategies to regulation motivation, these had immediate but no long-term negative effects. Finally, successful groups made statements to increase each other's effort and attention equally throughout the project.

The last finding in the qualitative analysis suggested that successful groups engaged in both effective self- and coregulation in their projects. In general, the information from group members' self-reported data was corroborated by information from the qualitative analysis. This suggested that students' calibrations of their SRL and CRL were relatively high. The benefit of using mixed methodologies to examine SRL and CRL in these groups was that (1) the quantitative analysis provided insight into students' perceptions of their SRL and CRL which I could not conclude from observation alone, while (2) the qualitative data provided insight into the quality of students' SRL and CRL which was not apparent from the quantitative data. Thus, using mixed methodologies led to a deeper understanding of how group members self- and coregulated cognition, motivation, and behavior in their projects. For the fashion group, using mixed methodologies was needed in order to understand the group's regulation processes. Using the quantitative data alone, it would have been difficult to understand how group members could have above average self-reported SRL and CRL, but a low overall performance score. Using the qualitative data allowed a deeper investigation into the quality of their self- and coregulation processes. Therefore, even if students' calibrations of their SRL and CRL processes were high, mixed methods were still needed in order to interpret these findings.

CHAPTER SIX

DISCUSSION

This dissertation examined self-regulation and coregulation processes students used as they worked in groups to design and implement an authentic, real-world, collaborative project based on their shared interests. Specifically, the research addressed the following questions:

1. Does participation in same- or mixed-aged groups predict students' reports of their SRL at the end of the project, after controlling for prior SRL?
2. Do motivational orientations, prior SRL, coregulation, final project assessment, and/or features of the intervention predict post-test scores of individuals' reports of SRL?
3. In a purposeful sample of four groups, what self- and coregulated processes do students use to regulate aspects of their cognition, motivation, behavior?
4. For the groups analyzed in question 3, how consistent are students' reports of their self-regulated and coregulated processes with their observed regulation processes?

In the following section, I will summarize the major findings related to each research question, and how these findings support, extend, or challenge the current literature. Then I will discuss the limitations of this study, highlighting the methodological and theoretical limitations. Finally, I will reflect on the significance of this work to both theory and practice.

Summary of Research Findings

Research Question 1

The first research question asked, Does participation in same- or mixed-age groups predict students' reports of their SRL at the end of the project after controlling for prior SRL? Piagetian and Vygotskian theories propose alternative hypotheses on group learning (see O'Donnell & O'Kelly, 1994). Specifically, a Piagetian view of peer learning (De Lisi & Golbeck, 1999) would advocate peers of equal status and mutual influence while a Vygotskian approach (Hogan & Tudge, 1999) would advocate more skilled others assisting less-skilled others. Research has been gathered that supported both hypotheses (see O'Donnell & O'Kelly, 1994). For instance, Kruger (1992) found that peer groups produced higher levels of reasoning and higher quality discourse on a moral reasoning task in contrast to mother-daughter dyads. In contrast, in the Reciprocal Teaching Technique, students have served as successful models and scaffolded younger students' learning effectively (Palinscar & Brown, 1984).

Alternatively, while research supported the claim that even young learners self-regulated (Perry, 1998), it was clear that not all types of regulation were equally effective and not all learners regulated all the time (Winne, 1995; Perry & Winne, 2006). One possible explanation for this finding was that developmental changes accounted for differences in students' use of regulatory processes (Zimmerman, 1990). This line of research posited that as individuals grew older, they were better able to (1) differentiate between different strategies, (2) self-assess their abilities and motivational orientations, and (3) monitor their learning (Pressley, Levin, & Ghatala, 1984).

Thus, research question 1 examined peer groups comprised of mixed-age and same-age peers to investigate whether differences existed in the degree to which mixed-age and same-age peer groups regulated their cognition, motivation, and behavior and the types of strategies they used to do so. To address this research question I relied on Hierarchical Linear Modeling (HLM; Raudenbush & Bryk, 2002, also known as multilevel modeling, Kreft & De Leeuw, 1998) as the primary statistical procedure. This analysis was used for this study because of the data's nested (i.e., hierarchical or clustered) structure. As a result, I was able to investigate the relationships between constructs that were embedded at multiple levels of analysis (Snijders & Bosker, 1999). The benefit of using HLM as opposed to OLS regression was that I avoided a potential violation of the independence assumption and I reduced the likelihood that standard errors would be underestimated and Type I error would be inflated.

The first finding suggested that students' condition (i.e., same age, mixed age) was not a significant predictor of time three SRL scores after controlling for prior level SRL. That is, whether students were in a same-age or mixed-age group did not help explain group differences in time 3 SRL scores. One explanation for this finding was that this was a highly complex, ill-structured task that was novel to all students. The research on urban education has found that urban classrooms were primarily teacher centered and achievement was based on behavioral skills and fixed knowledge (Oakes, 2000). Furthermore, the research has found that students spent considerable time completing worksheets and reading from textbooks. Overall, rather than tasks that required students to be active learners, there was a culture of rote memorization in which students were passive learners (Oakes, 1999). Thus, the participation in a task that was real-world oriented, complex, and ill defined may have been equally novel to 6th and 8th grade students. As such, group members in both same-age groups and mixed-age groups had to learn how to regulate cognition, motivation, and behavior on this novel task and 8th graders did not have a particular advantage compared with 6th graders.

Another possibility was that students were not far enough apart in age for there to be meaningful differences in their SRL attributed to age. That is, developmental effects perhaps may have been more important if students were farther apart in age. Thus, including 8th graders in a group with 6th graders did not make it more likely that the group would have higher SRLT3 scores.

To my knowledge I am not aware of other research that has investigated same-age or mixed-age groups differences in self-regulated learning. However, there is research that has examined achievement differences associated with same-age and mixed-age grouping. For example, Damon and Killen (1982) found no difference in reading or math achievement between students taught in multi-age or same-age groups. As such, the authors concluded that working in groups with same-age or mixed-age peers was not as important as the quality of students' work in determining whether cognitive change would result. It appears from the literature that the major benefit to students working in mixed-age groups might be social emotional benefits. For example, while Damon and Killen (1982) did not find any achievement related differences in mixed- and same-age groups, students in the mixed-age group outperformed their same-age peer groups on every measure related to emotional and social growth. Thus, perhaps the benefits of mixed-age grouping were in areas that were not explicitly measured as part of the current study. Thus, because age was not an important predictor of differences in groups SRL, I examined other variables that may account for the differences between groups.

Research Question 2

The second research question asked, Do motivational orientations, prior SRL, coregulation, final project assessment, and/or features of the intervention predict post-test scores of individuals' reports of SRL? A two-level HLM analysis was used to investigate this research question. First, groups with higher performance were more likely to have high SRL time 3 scores after controlling for prior SRL, motivational orientation, and perceptions of task features. This indicated that those groups who were successful on their end product also showed higher time 3 SRL, holding the other variables constant. One implication for this finding was that when groups performed well on this project, individual SRLT3 scores also increased. Because I controlled for other time 1individual-level variables, this finding suggested that doing well on this project corresponded to improvement in group members' individual SRL as well.

Similarly, the data suggested a positive relationship between coregulation and time 3 SRL after controlling for groups' prior SRL, motivational orientation, and perceptions of task features. This suggested that even after accounting for potential within group differences, their ability to effectively coregulate cognition, motivation, and behavior, was a significant predictor of individual time 3 SRL. The importance of this finding was that it suggested that when groups coregulated effectively, it corresponded to improvements in individual SRL. Thus, interventions to support effective group coregulation would be likely to correspond with increases in individual members SRL. While theoretically researchers have hypothesized a relationship between students' coregulation and self-regulatory processes (e.g., Corno & Mandinach, 2004; Hadwin & Oshige, 2007; McCaslin& Hickey, 2001), this research added empirical support to this claim. It also lent support to qualitative findings (e.g., Järvela & Järvenoja, 2007) that suggested the existence of coregulatory processes when students worked on collaborative tasks.

Social cognitive models also suggested individuals have certain motivational orientations (i.e., individual characteristics) that influence them as they self-regulate. Research on individuals' motivational orientations included research on self-efficacy, attributions, goal orientations, values, and interest and one's SRL. In general, research suggested positive, reciprocal relationships between these constructs and the amount and type of SR strategies individuals employed. Consistent with previous theoretical findings, the data suggested a significant positive relationship between students' motivation and time 3 SRL. That is, groups whose members had high motivation also showed significant increases in their SRL over the course of the project. The implication of this finding was that it suggested a need to assess students' motivational orientations prior to assigning them to collaborative work, because regardless of what group students were assigned to, their motivational orientations had a positive relationship with subsequent improvements in SRL. Thus, if students had low motivation, then interventions aimed at increasing their motivation before assigning them to group work would be needed, if the goal was for group members to improve their SRL within the collaborative environment. The relationship between students' motivational orientation and SRL is well documented (see Schunk & Zimmerman, 2008 for a review); however, this dissertation extended this work by suggesting that motivational orientation also positively predicted changes in SRL over time.

Next, the relationship between motivation and time 3 SRL was not significantly different for groups with higher/lower performance. In other words, the relationship between individual member's motivation and time 3 SRL remained consistent, regardless of whether students were in a successful or unsuccessful group. Thus, group performance was not a significant moderator of the relationship between individual motivation and SRLT3, which suggested that this relationship was resistant to group performance. Another finding from this analysis suggested that the relationship between motivation and SRLT3 was stronger for groups with higher self-reported coregulation, while holding SRLT1 and perceptions of task features constant. In other words, coregulation had an interactive effect on the relationship between individuals' motivation and increases in their SRL. One implication for this finding is that interventions aimed at increasing or supporting effective coregulation processes in groups, could improve (i.e., make it stronger) the relationship between students' motivation and SRLT3. Thus, there should be efforts to support these processes when students engage in group work.

There was a significant positive relationship between individual's beginning level SRL and their SRL at time 3, while holding motivation and perception of task features constant. Thus, higher levels of beginning SRL corresponded to higher levels of SRL at time 3. The implication here was that students who had higher SRL to begin with, also had the most significant improvements in SRL over the course of the project. Thus, interventions aimed at increasing SRL before students engaged in group work, may help support the development of their SRL in groups. Furthermore, it suggested that students' beginning SRL should be taken into account before determining the group's composition. Thus, contrary to examining the correlation among variables (e.g., Grant & Dweck, 2003; Schiefele, 1992; Zimmerman & Martinez-Pons, 1990), or the relationship among SRL and achievement (e.g., Zimmerman, Bandura, & Martinez-Pons, 1992; Miller, Greene, Montalvo, Ravindran, & Nichols, 1996; Pintrich & DeGroot, 1990; Wolters & Pintrich, 1998) this research extended the current literature by suggesting students' prior SRL was an important predictor of SRL at the end of this nine-week period.

Next, the data suggested that the relationship between SRLT1 and SRLT3 was not different for groups with higher/lower final assessment rubric scores (i.e., performance), after holding motivation and perceptions of task features constant. This was consistent with the finding above regarding the relationship between motivation and SRLT3. That is, the relationship between group members' SRLT1 and time 3 SRL remained consistent, regardless of whether students were in a successful or unsuccessful group. Thus, group performance was not a significant moderator of the relationship between beginning level SRL and SRLT3, suggesting that this relationship was resistant to the group's performance. This supported the need to take into account individual level variables (e.g., prior SRL and motivation) before forming groups, because the relationship between these individual level variables and SRL was resistant to the group's performance. Thus, interventions aimed to prepare students for group work by increasing motivation and SRL could correspond to greater improvements in their SRL over the course of the project.

Alternatively, there was a statistically significant affect of coregulation on the relationship between SRLT1 and SRLT3. That is, the relationship between these variables was stronger in successful groups, when holding motivation and perceptions of task features constant. In other words, coregulation had an interactive effect on the relationship between individuals’ beginning level SRL and ending level SRL. One implication for this finding is that interventions aimed at increasing or supporting effective coregulation processes in groups could improve the relationship between students SRLT1 and SRLT3. Thus, groups with individuals who had high beginning SRL and who used effective coregulation processes had the most significant increases in SRL as a result of the group work.

According to the individual SRL research, tasks that are complex and personally meaningful can provide natural opportunities for students to apply and develop SRL strategies (Perry, 1998). That being said, the current research suggested a significant positive relationship between students’ perceptions of task features and time 3 SRL. As such, increases in students’ perceptions of task features corresponded to increases in SRL time 3 scores. This suggested that students’ perceptions of task features were important, because they significantly predicted students’ improvement in SRL over the course of this project. Thus, when designing a task it is important that students perceive that the task (1) supported autonomy, (2) was interesting and optimally challenging, and (3) was valuable, because these features corresponded with increases in time 3 SRL. Thus, this finding supported current research that suggested certain task features were conducive for the development of SRL.

In addition, the data suggested that the relationship between perceptions of task features and SRLT3 was not different (1) for groups with higher/lower final assessment rubric scores (i.e., performance) or (2) for groups with higher coregulation, after holding motivation and SRLT1 constant. Thus, the relationship between students’ perceptions of task features and time 3 SRL remained consistent, regardless of whether students were in a successful or unsuccessful group or whether the group effectively coregulated. In other words, group performance and effective coregulation were not significant moderators of the relationship between perceptions of task features and SRLT3, which suggested that this relationship was resistant to these group level variables.

Finally, the results of the OLS regression model suggested that groups' coregulated learning was a significant predictor of group performance. That is, groups who effectively coregulated cognition, motivation, and behavior also had high project assessment scores. This finding suggested that how well groups coregulated each other on this project corresponded to how successful they were on their projects. Because effective coregulation predicted high performance, the data suggested a need to support the use of these processes in collaborative learning environments. Over the last twenty years the literature on self-regulated learning (SRL) focused primarily on the subsequent benefits SRL has had on learning and performance (Boekaerts & Niemivirta, 2000; Corno & Mandinach, 2004; Hadwin, Wozney, & Pontin, 2005; Perry, 1998; Pintrich & Zusho, 2002; Winne, 2001; Wolters, Pintrich, & Karabenick, 2005; Zimmerman, 1989; 1990; 2000). This finding suggested that a group's ability to effectively coregulate may also benefit achievement as well.

Research Question 3

Research question 3 asked, What self- and coregulated learning processes do students use to regulate cognition, motivation, and behavior? Thus, while research questions 1 and 2 focused on overall SRL and coregulation processes, research question 3 examined the subprocess and strategies individuals use to self- and coregulate.

Furthermore, instead of using self-reported statements, this investigation relied on direct observation of students' attempts to self- and coregulate over a nine-week period. Therefore, this present research extended other studies that have collected observational data rather than self-reports (Dweck & Leggett, 1988; Pintrich, 2000) in that it examined self- and coregulatory processes over a relatively long-term time period in which students worked on a complex, ill structured task. These analyses led to two general findings: (1) there were both within-group and between-group differences in the number of instances in which groups self- and coregulated cognition, motivation, and behavior, and these findings suggested a possible trend over time in regulatory processes in successful groups; and (2) successful groups engaged in different, but equally effective forms of coregulation, and this differed from regulation processes in the fashion group.

The relationship between amount of SRL and performance has been argued, (Dembo & Eaton, 1997, Zimmerman & Risemberg, 1997). However, the present research extended this finding by examining SRL processes independently and over time. First, for the successful groups the total instances of planning, monitoring, and evaluation had a linear trend over time. Although regulatory processes within each area often occurred linearly, they could have occurred simultaneously and/ or dynamically, and in some instances processes may have become automated and outside of the individual's consciousness (Winne & Hadwin, 2006). Successful groups were also more likely to regulate motivation and behavior (in terms of total instances) more equally over their projects. In contrast, the fashion group differed from the successful groups in that they engaged in the majority of product planning instances and behavioral regulation during times 2 and 3. Moreover, process planning and content monitoring were highest in time

1. Alternatively, this group was similar to the successful groups in that they evaluated during the latter end of their projects. However, all groups engaged in evaluation processes of their own or each other's contributions less often (N = 60) than other regulatory processes such as planning (N = 432) and monitoring (N = 589). In general the literature on self-regulated evaluation processes in collaborative groups suggested that students did not engage in these processes frequently, in part because they lacked appropriate knowledge of various evaluative strategies and specific criteria on which to evaluate their own and each other's contributions (Abram, Scarloss, Holthuis, Cohen, Lotan, & Schultz, 2002). There has been some success in improving students' use of evaluation processes by providing them with specific, clear criteria which they can use to evaluate their own and each other's work.

In all groups, except for evaluation processes and behavioral regulation processes for the fashion group, all other regulation processes, in general, decreased in time 3. For week 1 in time 3, students were finishing up their projects, but for week 2 in time 3 each group constructed a power point presentation for their project. The decrease in regulation scores in time 3 may suggest that there were qualitative differences between when students were working on their projects and when students constructed their power point slides. Perhaps for students in these groups, constructing a power point presentation was a routine task, and thus did not require extensive regulation processes. The research on the differences between routine and nonroutine tasks may help to explain the reduction in self- and coregulation for some SR processes. For example, Reeve (1996) has argued that routine tasks were less likely to encourage perceptions of interest and intrinsic motivation. Furthermore, additional research suggested that monitoring may also be less likely in routine tasks (Hackman, 1995).

When multiple students worked in a collaborative learning environment, coregulated learning included all of the following:

1. A single more regulated group member coregulated another group member(s).
2. The role of the MRO alternated among group members depending on whose regulatory processes were better suited for a particular task.
3. Several group members shared in regulating each other's regulatory activities simultaneously.

Because the soccer group was equally as successful on the project as the car and dinosaur groups, there was no current evidence to suggest one form of coregulation was better than the other. Alternatively, it was more important that the group refined project ideas as they engaged in product planning. Moreover, successful groups coregulated both task and content monitoring to ensure that process planning tasks were accomplished and group members were aware of each other's research. In addition, these groups made explicit efforts to monitor how group members' ideas and research related to the overall goals of the project. Thus, it served to keep the group focused and on task toward their shared goals. In terms of evaluation processes, successful groups engaged in at least equal amounts of content and mechanics evaluation processes. Moreover, all three successful groups engaged in Vygotskian coregulated evaluation processes, while the car group was the only group to share in evaluation processes. Successful groups were also more likely to engage in productive motivational strategies, in that these strategies increased participation, persistence, and engagement. When group members used potentially unproductive strategies to regulation motivation, these had immediate but no long-term negative effects. Finally, successful groups made statements to increase each other's effort and attention more equally throughout the project compared to the unsuccessful group.

This type of effective coregulated product planning was contrasted by analyzing product planning in the fashion group. In the fashion group, project ideas were proposed and accepted without developing them enough for group members to have a clear understanding of the scope of the project. The result of ill-defined project ideas was that when this group engaged in process planning, either (1) they failed to ask themselves how these tasks related to the project idea or (2) alternatively, they performed tasks related to project ideas, but because ideas were broad, and vaguely defined, all tasks seemed relevant. This could potentially account for high instances of process planning in time 1, and could also explain why high instances of process planning did not necessarily denote project success.

Research Question 4

Research question 4 asked, For the groups analyzed in question 3, how consistent are students' reports of their self- and coregulation processes with their observed regulation processes? SRL is an internal process and consequently, researchers must draw inferences about cognitive operations that they cannot directly observe (Webb, Nemer, Chizhik, & Sugrue, 1995). As a result, researchers have primarily relied on self-report measures as measures of students' regulatory processes. Although self-report data have added significant knowledge about students' perceptions of their SRL to the literature, a complete reliance on self-report data raised validity issues as to the extent to which students’ perceptions reflected their actual performance (Perry & Winne, 2006). For example, Winne and Jamieson-Noel (2002) found low calibration between students’ traced measures of SRL and their self-reported measure of SRL. Because self-report questionnaires did not take into account the context in which students’ responses were framed, interpreting such data was problematic. Furthermore, self-reports could be inaccurate or incomplete, especially with young children who often confused intention with action. Thus, if the child intended to concentrate or do good work, this was often reported as actually concentrating and doing good work. Young children were also generally optimistic and displayed positive result bias (Turner, 1995). Furthermore, they often struggled with the language, which biased the results of many self-report measures. Because self-report measures could be considered one indication of students’ self-monitoring skills, more research is needed to discern the relationship between students’ actual and students’ self-reported SRL (Zimmerman, 2008). As such, researchers have established other measures to be used in conjunction with self-report data in order to triangulate research findings. This dissertation included qualitative analyses of group interactions with quantitative measures of students’ SRL reports to triangulate data about students’ self-regulation processes.

In general, the information from group members’ self-reported data was corroborated by information from the qualitative analysis. This suggested that students’ calibrations of their SRL and CRL were relatively high. The benefit of using mixed methodologies to examine SRL and CRL in these groups was that (1) the quantitative analysis provided insight into students’ perceptions of their SRL and CRL, which I could not conclude from observation alone; while (2) the qualitative data provided insight into the quality of students' SRL and CRL, which was not apparent from the quantitative data. Thus, using mixed methodologies led to a deeper understanding of how group members self- and coregulated cognition, motivation, and behavior in their projects. For the fashion group, using mixed methodologies was needed in order to understand the group's regulation processes. Using the quantitative data alone, it would have been difficult to understand how group members could have above average self-reported SRL and CRL, but a low overall performance score. Using the qualitative data allowed a deeper investigation into the quality of their self- and coregulation processes. Therefore, even if students' calibrations of their SRL and CRL processes were high, mixed methods were still needed in order to interpret these findings.

This supported findings from Turner and Patrick (2004) who also concluded that relying exclusively on self-report measures failed to capture the reasons why students engaged in whole class or small group discussions; and that they do not explain changes over time. In their research, they followed two students who were in the same elementary school classroom, but different middle school classrooms to study their participation in math. They collected self-report data on students' goals, and their perceptions of teacher support and the goal structures of the classroom, along with qualitative notes from their visits. While there was little change in items measured on the self-report measure over time, their qualitative analysis revealed that their participation in the classroom changed dramatically. Thus, the authors argued for mixed methods in order to triangulate data from multiple approaches.

The Task Itself

According to the individual SRL research, tasks that were complex and personally meaningful provided natural opportunities for students to apply and develop SRL strategies (Perry, 1998). Although this literature has focused on task characteristics that promoted individual SRL, I propose that these same task features could also promote coregulation when students work in a collaborative group setting. Complex, personally meaningful tasks are well suited to study the social origins of self- and coregulated learning because these tasks require students to work together, coordinating multiple cognitive, motivational, behavioral processes to construct various products. Furthermore, because complex, meaningful tasks potentially require students to use various forms of self- and coregulation in order to execute the task successfully, they create a potential context for students to develop and refine these skills, as well as for researchers to investigate these processes in practice. In addition to tasks being complex and personally meaningful, the literature on collaborative learning also offers a number of other task features that led to effective group interactions. According to that research, tasks that (1) were ill structured, (2) based on important, intellectual material, (3) required positive interdependence and individual accountability, and (4) included a set of evaluative criteria to determine successful performance led to more effective collaboration among group members (Lotan, 2003).

In the current research, students worked collaboratively to design and carry out a project with students who share similar interests. Teachers acted as facilitators to help students focus their areas of interest, formulate a plan, model appropriate information seeking strategies, and assess their projects. Ultimately, however, the responsibility for a successful project rested with the students. The openness of the task, which afforded students the opportunity to select a topic and plan how to solve it, the authenticity of this task, and its long-term duration created an appropriate context to investigate how peers potentially facilitate self- and coregulated skill development. Because students were allowed to investigate topics that were of interest to them, group projects had the potential to be inherently interesting and meaningful to students. For example, when students were provided with opportunities to explore topics that were interesting and important to them, it was likely that they would be motivated to participate and engage in their projects (Patrick & Middleton, 2002). Similarly, this context created opportunities for students to exert choice and control during their projects, which could have led them to initiate and develop purposeful cognitive and metacognitive engagement (Patrick & Middleton, 2002). Finally, these tasks required that students employ regulatory skills in order to manage their projects successfully (Perry, 1998). In order for students to be able to work collaboratively with others and explain or justify their ideas, they had to plan, monitor, and evaluative their ideas and actions. Furthermore, group members had to work together to set goals and design and carry out processes that were directed toward those goals, and monitor and evaluate their progress toward achieving their goals (Perry et al., 2004). Ideally, then, these contexts created a variety of opportunities for students to regulate their learning, and for me to investigate these processes (Patrick & Middleton, 2002).

The final way the task was designed to promote the development and use of self- and coregulated learning processes was by supporting students planning, monitoring, and evaluation processes through the use of the group binder. In these binders were a number of supporting materials to structure the development of students' group projects. These materials were given to students in their group binders so that they would have a place to store all information related to their projects. These materials were intended to (a) act as a scaffold to help group members brainstorm and elaborate on their shared themes, (b) ensure that group members could describe their projects in narrative form, (c) help students identify their learning goals for their project, and (d) serve as a record of their long-term plans. Also included in their binders were a number of materials intended to help group members manage their projects. These consisted of knowledge webs and research pages. The last item included in students' binders was a calendar section. This contained daily, weekly, and monthly calendars that students could use to help organize and manage their projects.

Thus, task features identified in the literature as well as artifacts were included in this research in order to promote and support students' development and use of self- and coregulation processes. Although these were explicitly used by the teachers, their function to students was more implicit. Overall, the quantitative and qualitative data supported the current literature, which has argued that certain task features benefited the development and use of SRL processes. Moreover, these findings extended current theories by suggesting certain task features also promoted the development and use of coregulation processes. So given that these task features were present and scaffolds were in place to help support students develop, manage, and evaluate their projects, why was the fashion group unsuccessful?

One reason why the fashion group was unsuccessful despite efforts to help support their success was because of their unrefined product planning. Recall that in the fashion group, project ideas were proposed and accepted without developing them enough for group members to have a clear understanding of the scope of the project. The result of ill-defined project ideas was that when the group process planned, either (1) they failed to ask themselves how these tasks related to the project idea or (2) alternatively, they performed tasks related to project ideas, but because ideas were broad, and vaguely defined, it made all tasks seem relevant. This differed from the car and dinosaur groups who engaged in explicit processes to refine their project ideas early on. Similarly, in the soccer group although project ideas were not refined by multiple group members, Henry assumed responsibility for elaborating and summarizing project ideas, thereby refining project ideas for the group. Because he engaged in this process in front of his group members, (1) they had a clear understanding of the scope of the project, and (2) project ideas were more developed as a result of the refinement process. Therefore, the failure of this group to clearly define and refine project ideas early on may have potentially contributed to their low performance on their project.

Furthermore, these data suggested that effective product planning and task monitoring were essential to the group's success. Efforts to self-regulate process planning did not benefit the group because there were few attempts to task monitor (N = 6). Moreover, even though group members engaged in self-regulated content monitoring, this did not benefit the group because group members did not link the information they found during research to their product planning goals. As such, in the group context, these data suggested coregulation and self-regulation are intertwined and highly related, and group's needed to engage in both effective self- and coregulation in their projects for them to be successful. Even though task features were in place to promote use of self-and coregulatory processes, the fashion group’s failure to effectively engage in these processes may be one reason why they were unsuccessful.

Limitations

One limitation of this study was the extensive time students worked on their projects. Overall, the project lasted nine weeks and students met for 45 minutes a day. This was a large commitment on the part of the school for this much time to be allocated to a single project. A second limitation of the study was that given the range of topics which students’ based their projects on, it was difficult for teachers to scaffold students’ work when they were not necessarily knowledgeable on that particular topic. Teachers who were knowledgeable in the same area of students’ projects were in a better position to ask more relevant questions, and to help guide students in the appropriate direction. In general, students needed a lot of support to do these projects. Even with all the materials created to promote students’ success on projects, there existed unsuccessful groups. Therefore, if I were to repeat this project, I would need to refine the materials further and perhaps group students with teachers who also shared in their interests.

There were methodological limitations as well. First, the relatively small sample size restrained the amount and complexity of the HLM models I was able to run. For example, instead of investigating the effect of different types of motivational orientations (e.g., self-efficacy, goal orientation) on SRLT3 scores, I had to use one composite score for all motivational orientation variables in the model. While using composite scores was a viable solution in order to be able to run HLM models, it could potentially conceal nuances in the data that I would have been able to investigate had I had a larger sample size. Furthermore, because I needed to include all 6th grade students in the study I was not able to have a control group. Another methodological limitation of the study was that I lacked interview data that would have allowed me to draw inferences about *why* students' used a particular regulation strategy. Absent these data, I was unclear about the purpose of proposed strategies and the effect a strategy had on the person being regulated. Finally, although the fashion group served as an interesting comparison group because of their ineffective self- and coregulation processes, in the future I would be interested in investigating a group where excessive regulation was damaging to the group's success. For example, it is possible that over-regulation may disrupt flow; for example, an extended discussion is discontinued so that the group continues to move forward. Moreover, it is possible that students could engage in self- and coregulation but they are regulating toward a negative goal. Thus, in the future I would like to explore these issues.

Educational Significance

To Theory

Theoretically, this research extended individual models of SRL that focused on individual differences to examine social forms of regulation. Instead of treating interpersonal, social, and/or cultural influences as separate variables that affected regulatory processes, this research argued that SRL is fostered, developed, and maintained (1) within social contexts and (2) as a result of interactions with peers. Here, the development of self-regulated learning was conceptualized as a social as well as individual process. Second, this research offered empirical evidence for three types of coregulation that were present in collaborative group interactions. Specifically, I presented evidence that supported coregulation as follows:

1. A single more regulated group member coregulated another group member(s).
2. The role of the MRO alternated among group members, depending on whose regulatory processes were better suited for a particular task.
3. Several group members shared in regulating each other's regulatory activities simultaneously.

Therefore, by using social cognitive and sociocultural theories, I offered an integrative approach to conceptualizing regulation that may serve to further understand self- and coregulation processes within a collaborative learning environment. From the quantitative results, I found that coregulated learning was a significant predictor of both change in SRL over time and final project assessment scores. From the qualitative data, I found that groups differed in both the frequency in which they coregulated and the types of coregulated learning they engaged in. These findings provided support to sociocultural theories that suggested coregulatory processes were present within collaborative group contexts and that groups used these processes in order to regulate their own and each other's cognition, motivation, and behavior. Thus, this research extended the current literature by investigating social models of self-regulation and offering empirical support for various types of coregulation.

To Practice

First, because collaborative learning is an instructional method teachers already use, or are at least familiar with, this approach capitalized on existing classroom practices. This lessened the need to implement new instructional methods, which may have required substantial time, effort, and resources, when students could have benefited from an existing method. Furthermore, because teachers are aware of the benefits of collaborative learning for achievement and effective technique for implementing it in their classrooms, adding an additional focus on strategy development avoided reinventing the wheel. Using this approach was also consistent with recent reform efforts in national and state standards that call for developing regulatory strategy use and employing collaborative learning (AAAS, 1993; NCTM, 2000). These standards are aimed at cultivating students' regulatory skills and group collaboration as a means of increasing their learning and subsequent achievement. As such, using collaborative learning to develop SRL was consistent with existing classroom instructional methods and met the requirements of national and state standards.

Second, given the increase in student-teacher ratios in the classroom it may become increasingly hard for teachers to implement traditional approaches for developing SRL (e.g., strategic training programs and tutoring programs). The appeal of using collaborative learning to develop students' SRL processes was that the practical problem of one teacher and many students could be solved by having students serve as more knowledgeable others to each other. Under these circumstances, expertise was shared among students and group members assumed a collective responsibility for helping each other develop regulatory skills. Increased interactions led to increased opportunities for students to learn new strategies as they worked collaboratively with their peers on joint tasks. Thus, using collaborative learning to develop SRL helped alleviate resource demands as well as capitalize on students' modeling and explaining processes.

Benefits to urban environments in particular. Students in urban school districts face challenges that students in the majority of suburban school districts do not (Seiler & Butler, 2005). This includes deteriorating physical conditions, broken or outdated equipment, limited resources, frequent instances of violence, increased teacher turnover rates, and high student to teacher ratios (Seiler & Butler, 2005, Oakes, 2000). The research on urban education has found classrooms were primarily teacher centered and achievement was based on behavioral skills and fixed knowledge (Oakes, 2000). Furthermore, the research suggested that students spent considerable time completing worksheets and reading from textbooks. Overall, rather than tasks that require students to be active learners, there was a culture of rote memorization in which students were passive learners (Oakes, 1999). Finally, the higher student-teacher ratios that characterize urban schools made it difficult to implement traditional training programs aimed at increasing students' regulation. As a consequence, researchers must look to other instructional designs to help students in urban schools develop and practice self-regulatory skills. Because over 20% of students in the United States attend urban schools, more work needs to be done to improve urban education in our country (Oakes, 1999).

Specifically, using peers to develop regulatory skills mitigated limited resource demands in urban schools due to high student- teacher ratios by capitalizing on students' ability to teach one another regulatory strategies (NRC, 2003). While it is important for all students to learn how to self-regulate effectively, students from urban school districts are less likely than their middle/upper middle class counterparts to possess the skills and knowledge demanded by colleges, employers, and trade schools to succeed (NRC, 2003). Thus, for those peers with less-developed behavior, cognitive, and/or motivational regulation strategies, joint work on the collaborative task can create an opportunity to learn strategies from other group members which in turn may develop their own self-regulated learning and subsequently improve their academic achievement.

Thus, using collaborative learning as a context for students to acquire and refine self-regulatory strategies was not only theoretically appealing but also it was practically useful given that, (1) teachers already used these techniques in their classrooms (Antil, Jenkins, Wayne & Vadasy, 1998), (2) reform efforts and national/state standards consistently advocate their use (NRC's National Science Education Standards, 1996; NCTM's Professional standards for teaching mathematics, 1991), and (3) they were a practical solution to ameliorate some of the challenges urban school face.

REFERENCES

Alexander, P. (1997). Mapping the multidimensional nature of domain learning: The interplay of cognitive, motivational, and strategic forces. In M. L. Maehr & P. R. Pintrich (Eds.), *Advances in motivation and achievement* (pp. 213-250). Greenwich, CT: JAI.

Alexander, P. A., Sperl, C .T., Buehl, M. M., Fives, H., & Chiu, S. (2004). Modeling domain learning: Profiles from the field of special education. *Journal of Educational Psychology, 96,* 545-557.

Arvaja, M., Salovaara, H., Hakkinen, P., & Jarvela, S. (2007). Combining individual and group-level perspectives for studying collaborative knowledge construction in context. *Learning and Instruction, 17,* 448-459.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A., Barbaranelli, C., Caprara, G.V., & Pastorelli, C. (1996). Multifaceted impact of self-efficacy beliefs on academic functioning. *Child Development, 67,* 1206-1222.

Bandura, A., Barbaranelli, C., Caprara, G.V., & Pastorelli, C. (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Development, 72,* 187-206.

Bargh, J. A. & Shul, Y. (1980). On the cognitive benefits of teaching. *Journal of Educational Psychology, 72,* 593-604.

Boekaerts, M., & Niemivirta, M. (2000). Self-regulated learning: Finding a balance between learning goals and ego-protective goals. In m. Boekaerts, P. Pintrich, & M. Zeidner (Eds.), *Handbook of Self-Regulation* (pp. 417-446). San Diego, CA: Academic Press.

Bouffard-Bouchard, T., Parent, S., & Larivee, S. (1991). Influence of self-efficacy on self-regulation and performance among junior and senior high-school age students. *International Journal of Behavioral Development, 14,* 153-164.

Bruning, R, Schraw, G., & Ronning (1995). *Cognitive psychology and instruction. Second Edition.* Englewood Cliffs, NJ: Prentice-Hall.

Butler, D. L. (2002). Qualitative approaches to investigating self-regulated learning: Contributions and challenges. *Educational Psychologist, 37,* 59-63.

Butler, D. & Winne, P. H. (1995). Feedback as self-regulated learning: A theorectical synthesis. *Review of Educational Review, 65,* 245-281.

Chinn, C. A., O'Donnell, A. M., & Jinks, T. (2000). The structure of discourse in collaborative learning. *The Journal of Experimental Education, 69,* 77-97.

Cleary, T. J., & Zimmerman, B. J. (2001). Self-regulation differences during athletic practice by experts, non-experts, and novices. *Journal of Applied Sport Psychology, 13,* 185-206.

Cohen, B. P., & Arechevala-Vargas (1987). *Interdependence, interaction, and productivity* (Working paper No. 87-3). Stanford: Center for Sociological Research.

Cohen, E. G. (1991). Teaching in multiculturally heterogeneous classrooms: Findings from a model program. *McGill Journal of Education, 26,* 7-23.

Cohen, E. G. (1994). Restructuring the classroom: Conditions for productive small groups. *Review of Educational Research, 64,* 1-35.

Cohen, E. G. & Lotan, R. A. (Eds.) (1997). *Working for equity in heterogeneous classrooms: Sociological theory in practice.* New York: Teachers College Press.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Risnick (Ed.) *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (p. 453-494). Hillsdale, NJ: Lawrence Erlbaum.

Corno, L. (1994). Student volition and education: Outcomes, influences, and practices. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance* (pp. 229-251). Hillsdale, NJ: Erlbaum.

Corno, L. & Randi, J. (1999). A design theory for classroom instruction in self-regulated learning. In C. M. Reigeluth (Ed.). *Instructional theories in action: Lessons illustrating selected theories and models.* (293-318). NJ: Erlbaum Associates.

Corno, L. (2001). Volitional aspects of self-regulated learning. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theorectical perspectives* (pp. 191-226). New York: Lawrence Erlbaum Associates.

Corno, L, (2006). Commentary on Vollmeyer and Rheinberg: Putting the teacher in research on self-regulated learning E*ducational Psychology Review.18,* 261-266.

Corno, L., & Mandinach, E. B. (2004). What we have learned about student engagement in the past twenty years. In D. M. McInerney & S. V. Etten (Eds.), *Big Theories Revisited* (Vol. 4). Greenwich, CT: Information Age Publishing.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five designs*. Thousand Oaks, CA: Sage.

Csikszentmihalyi, M. (1990). *Flow, The psychology of optimal experience.* New York: Harper Collins

Dansereau, D. F. (1988). Cooperative learning strategies. In C. E. Weinstein, E. T. Goetz, & P. A. Alexander (Eds), *Learning and study strategies: Issues in assessment, instruction, and evaluation* (pp. 103-120). New York, NY: Academic Press.

De Lisi, R., & Golbeck, S.L. (1999). The implications of Piaget’s theory for peer learning. In A. O’Donnell & A. King (Eds.), *Cognitive perspectives on peer learning* (pp. 3-37). Hillsdale, NJ: Erlbaum.

Dillon, W. R. & Goldstein, M. (1984). *Multivariate analysis: Methods and applications.* New York, NY: John Wiley & Sons.

Dweck, C. (2000). *Self-theories: Their role in motivation, personality, and development.* Philadelphia, PA: Academic Press.

Eccles, J., Adler, T., Futterman, R., Goff, S., Kaczala, C., Meece, J., & Midgley, C. (1983). Expectancies, values, and academic behavior. In J. T. Spence (Ed.), *Achievement and achievement motives: Psychological and sociological approaches* (pp. 75-146). San Francisco, CA: Freeman.

Eccles, J. & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents’ achievement task values and expectancy-related beliefs. *Personality and Social Psychology Bulletin, 21,* 215-225.

Glaser, B.G., and Strauss, A. L. (1967). The discovery of grounded theory: Strategies for qualitative research. *Sociology Press*, *1*, pp. 271

Gorsuch, R. L. (1983). *Factor analysis* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates

Grant-Pillow, H. & Dweck, C.S. (2003). Clarifying achievement goals and their impact. *Journal of Personality and Social Psychology, 85*, 541-553.

Greene, J. A. & Azevedo, R. (2007). A theoretical review of Winne and Hadwin's model of self-regulated learning: New perspectives and directions. *Review of Educational Research, 77,* 334-372.

Grieshaber, S. (2001). Equity issues in research design, In G. MacNaughton, S. A. Rolfe, and I. Siraj-Blatchford (Eds.) *Doing early childhood research: international perspectives on theory and practice.* Australia: Allen & Unwin

Hadwin, A. & Oshige, M. (August, 2007). Self-regulation, co-regulation, and socially shared regulation: Examining the many faces of social in models of SRL. Paper presented at the European Association for Research on Learning and Instruction, Budapest, Hungary.

Hadwin, A. F., Wozney, L., & Pontin, O. (2005). Scaffolding the appropriation of self-regulatory activity: A social constructivist analysis of changes in student-teacher discourse about a graduate student portfolio. *Special Issue of Instructional Science, 33,* 413-450

Harackiewicz, J. M., Barron, K. E., Tauer, J. M., Carter, S. M. & Elliot, A. J. (2000). Short- term and long-term consequences of achievement goals: Predicting interest and performance over time. *Journal of Educational Psychology, 92,* 316-333.

Hedges, L. & Hedberg, E. C. (2007). Intraclass correlations for planning group randomized experiments in rural education. *Journal of Research in Rural Education, 22*(10).

Heller, P., & Hollabaugh, M. (1992). Teaching problem solving through cooperative grouping, Part 2: Designing problems and structuring groups. *American Journal of Physics, 60,* 627-636.

Hidi, S. (1990). Interest and its contribution as a mental resource for learning. *Review of Educational Research, 60,* 549-571.

Hidi, S. & Harackiewicz, J. (2000). Motivating the academically unmotivated: A critical issue for the 21st century. *Review of Educational Research, 70,* 151-179.

Hmelo-Silver, C. E. (2003). Analyzing collaborative knowledge construction: Multiple methods for integrated understanding. *Computers & Education*, 41, 397-420.

Hofer, B. K. & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67,* 88-140.

Hogan, D. M., & Tudge, J. R. H. (1999). Implications of Vygotsky's theory for peer learning. In A. M. O'Donnell & A. King (Eds.), *Cognitive perspectives on peer learning* (pp. 39-65). Mahwah, New Jersey: Lawrence Erlbaum.

Howard, B., McGee, S. Shia, R., & Hong, N. (2000, April). *Metacognitive self-regulation: How do you solve problems.* Paper presented at the 2000 Annual Meeting of the American Educational Research Association, New Orleans.

Huber, G., & Eppler, R. (1990). Team learning in German classrooms: Processes and outcomes. In S. Sharan (Ed.), *Cooperative learning: Theory and research* (pp. 23-37). New York: Praeger.

Järvela, S. & Järvenoja, H. (August, 2007). Socially constructed self-regulated learning in collaborative learning groups. Paper presented at the European Association for Research on Learning and Instruction, Budapest, Hungary.

Johnson, D. & Johnson, R. (1990). Cooperative learning and achievement. In S. Sharan (Ed.), *Cooperative learning: Theory and research* (pp.23-37). New York: Praeger.

Johnson, D., Johnson, R., & Stanne, M. (1990). Impact of goal and resource interdependence on problem solving success. *Journal of Social Psychology, 129,* 507-516.

Kempler, T. M., & Linnenbrink, E. A. (2006). Helping behaviors in collaborative groups in math: A descriptive analysis. In S. A. Karabenick & R. S. Newman (Eds.), *Help seeking in academic settings: Goals, groups, and contexts* (pp. 89-115). Mahway, NJ: Lawrence Erlbaum Associates.

Kempler, T. M. & Linnenbrink, L. G. (August, 2007). Exploring self-regulation in group contexts. Paper presented at the European Association for Research on Learning and Instruction, Budapest, Hungary.

Kerlinger, F. N. (1986). *Foundations of behavioral research* (3rd Ed.) New York, NY: Holt, Rinehart & Winston.

King, A. (1992). Facilitating elaborative learning through guided student-generated questioning. *Educational Psychologist, 27,* 111-126.

King, A. (1998). Transactive peer tutoring: Distributing cognition and metacognition. *Educational Psychology Review*, *10*(1), 57–74.

King, A. (1999). Discourse patterns for mediating peer learning. In A. M. O'Donnell & A. King (Eds.), *Cognitive perspectives on peer learning.* Mahwah, NJ: Lawrence Erlbaum.

King, P. M., & Kitchener, K. S. (1994). Developing reflective judgment: Understanding and promoting intellectual growth and critical thinking in adolescence and adults. San Francisco, CA: Jossey-Bass.

Kline, R. B. (1998). Principles and practices of structural equation modeling. New York, Guilford Press.

Krapp, A. (1999). Interest, motivation, and learning: An educational psychological perspective. *European Journal of Psychology of Education, 14,* 23-40.

Kreft, I. & De Leeuw, J. (1998). *Introducing multilevel modeling*. Thousand Oaks, CA: Sage.

Kruger, A.C. (1992). The effect of peer and adult-child transactive discussions on moral reasoning. *Merrill-Palmer Quarterly, 38,* 191-211.

Linnenbrink, E. A. (2005). The dilemma of performance-approach goals: The use of multiple goal contexts to promote students' motivation and learning. *Journal of Educational Psychology, 97*(2), 197-213.

Logan, G. D. (1988). Toward an instance theory of automatization. *Psychological Review, 95,* 492-527.

Lotan, R. A. (2003). Group worthy tasks. *Educational Leadership,* 72-75.

Martin, A. (2006). The relationship between teachers' perceptions of student motivation and engagement and teachers' enjoyment of and confidence in teaching. *Asia-Pacific journal of Teacher Education, 34(1)*, 73-93.

Martinez-Pons, M. (1999, April). *Cultural differences in parental and teacher inductive behavior of academic self-regulation*. Paper presented at the 1999 Annual Meeting of the American Educational Research Association, Montreal.

McCaslin, M., & Good, T. (1996). *Listening in classrooms.* New York, NY: Harper Collins.

McCaslin, M. & Hickey, D. T. (2001). Self-regulated learning and academic achievement: A Vygotskian view. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives* (pp. 227-252). New York: Lawrence Erlbaum Associates.

McCombs, B. L., & Whisler, J. S. (1989). The role of affective variables in autonomous learning. *Educational Psychologist, 24*(3), 277-306.

Meece, J., Blumenfeld, P., & Hoyle, R. (1988). Students goal orientations and cognitive engagement in classroom activities. *Journal of Educational Psychology, 80,* 514-523.

Meyer, D. & Turner, D. (2002). Using instructional discourse analysis to study the scaffolding of student self-regulation. *Educational Psychologist, 37,* 17-25.

Midgley, C., Maehr, M., Hruda, L., Anderman, E., Anderman, L., Freeman, K., Gheen, M., Kaplan, A., Kumar, R., Middleton, M., Nelson, J., Roeser, R. & Urdan, T. (2000). *Manual for the patterns of adaptive learning scales.* Retrieved on 11/7/07 from http://www.umich.edu/~pals/index.html.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: A sourcebook of new methods* (2nd ed.). Newbury Park, CA: Sage.

Miller, R. B., Greene, B. A., Montalvo, G. P., Ravindran, B., & Nichols, J. D. (1996). Engagement in academic work: The role of learning goals, future consequences, pleasing others, and perceived ability. *Contemporary Educational Psychology, 21*(288-422).

Montalvo, F., & Torres, M. (2004). Self- regulated learning: Current and future directions. *Electronic Journal of Research in Educational Psychology, 2*, 1-34.

Murphy, P. K. & Alexander, P. A. (2002). What counts? The predictive powers of subject matter knowledge, strategic processing, and interest in domain-specific performance. *Journal of Experimental Education, 70,* 197-214.

Newman, R. S. (2000). Social influences on the development of children's adaptive help seeking: The role of parents, teachers and peers. Developmental Review, 20, 350-404.

Norusis, M. J. (2007). *SPSS 15.0 guide to data analysis.* Upper Saddle River, NJ: Pearson.

O'Donnell, A. M. & O'Kelly, J. (1994). Learning from peers: Beyond the rhetoric of positive results. *Educational Psychology Review, 4,* 321-349.

Paas, F., & Kester, L. (2006). Learner and information characteristics in the design of powerful learning environments. *Applied Cognitive Psychology, 20,* 281-285.

Pajares, F. *Self-efficacy scales*. Retrieved on 11/7/07 from http://des.emory.edu/mfp/MSCP-MFP2007Comp.html

Palinscar, A. S. & Brown, A. (1994). Reciprocal teaching of comprehension fostering and monitoring activities. *Cognitive Instruction, 1,* 117-175.

Patrick, H. & Middleton, M. (2002). Turning the kaleidoscope: What we see when self-regulated learning is viewed with a qualititative lens. *Educational Psychologist, 37,* 27-39.

Patton, M. Q. (2002). *Qualitative evaluation and research methods* (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Pedhazur, E. J. (1997). *Multiple regression in behavioral research, (pp. 675-711)*. Harcourt Brace: Orlando, FL.

Perry, N. E. (1998). Young children's self- regulating and the contexts that promote it. *Educational Psychologist, 90*, 715-729.

Perry, N. E. (2002). Introduction: Using qualitative methods to enrich understandings of self-regulated learning. *Educational Psychologist, 37*, 1-3.

Perry, N. Phillips, L. & Dowler, J. (2004). Examining features of tasks and their potential to promote self-regulated learning. *Teachers College Record, 106,* 1854-1878.

Perry, N., & Winne, P. (2006). Learning from learning kits: GStudy traces of students' self- regulated engagements with computerized content. *Educational Psychology Review,* 211-228.

Peterson, C. (1990). Explanatory style on the classroom and on the playing field. In S. Graham and V. Folkes (Eds.), *Attribution theory: Applications to achievement, mental health, and interpersonal conflict* (pp. 53-75). Hillsdale, NJ: Lawrence Erlbaum.

Pintrich, P. R. (1989). The dynamic interplay of student motivation and cognition in the college classroom. In M. Maehr & C. Ames (Eds.), *Advances in motivation and achievement* (Vol. 6, pp.117-160). Greenwich, CT: JAI Press.

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451-502). San Diego, CA: Academic Press.

Pintrich, P. R., & de Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82*(1), 33-40.

Pintrich, P. R., Wolters, C., & Baxter, G. P. (2000). Assessing metacognition and self-regulated learning. In G. Schraw, & J. C. Ampara (Eds.), *Issues in the measurement of metacognition.* (pp. 43-97). Lincoln, NE: University of Nebraska Press.

Pintrich, P.R., Zusho, A. (2002). The development of academic self-regulation: The role of cognitive and motivational factors. In A. Wigfield & J. Eccles (Eds.), *The development of achievement motivation* (pp. 250-279). San Diego, CA: Academic Press.

Pokay, P., & Blumenfeld, P. C. (1990). Predicting achievement early and late in the semester: The role of motivation and use of learning strategies. *Journal of Educational Psychology, 82,* 41-50.

Pressley, M., Levin, J. R., & Ghatala, E. S. (1984). Memory-strategy monitoring in adults and children. *Journal of Verbal Learning and Verbal Behavior, 23*, 270-288.

Raudenbush, S. W. & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods*. Newbury Park: Sage Publications

Raudenbush, Bryk, Cheong, Congdon, & du Toit, (2004). HLM 6.02; Scientific Software International, Retrieved January 7, 2009 from http://www.ssicentral.com.

Raudenbush, S., Spybrook, J., Liu, S., Congdon, R. & Martinez, A. (2006). Optimal Design for Longitudinal and Multi-level Research (Version 1.77) [Computer software]. University of Michigan, Ann Arbor: Survey Research Center. Retrieved January 7, 2009 from http://sitemaker.umich.edu/group-based/files/odmanual-20060517-v156.pdf

Renninger, K. A. (1990). Children's play interests, representation, and activity. In R. Fivush & J. Hudson (Eds.), *Knowing and remembering in young children* (pp. 127-165). Emory Cognition Series (Vol. 3). Cambridge, MA: Cambridge University Press.

Renninger, K. A. (1992). Individual interest and development: Implications for theory and practice. In K. A. Renninger, S. Hidi, & A. Krapp (Eds.), *The role of interest in learning and development* (pp. 361-376). Hillsdale, NJ: Lawrence Erlbaum Associates.

Renninger, K. A. (1998). The roles of individual interests) and gender in learning: An overview of research on preschool and elementary school-aged children/ students. In L. Hoffmann, A., Krapp, K. Renninger, & J. Baumert (Eds.), *Interest and learning: Proceedings of the Seeon Conference on interest and gender* (pp. 165-175). Kiel, Germany: IPN.

Renninger, K., Hidi, S., & Krapp, A. (Eds.) (1992). *The role of interest in learning and development.* Hillsdale, NJ: Erlbaum.

Resnick, L., Levine, J. M., & Teasley, S. D. (Eds.). (1991). *Perspectives on socially shared cognition.* Washington, D. C.: American Psychological Association.

Ridley, D.D. (1991). Reflective self-awareness: A basic motivational process. *Journal of Experimental Education, 60*, 31-48.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context.* Oxford University Press, New York.

Rosenshine, B., & Meister, C. (1994). Reciprocal teaching: A review of the research. *Review of Educational Research, 64,* 479-530.

Ryan, R. (1983). *Post experimental intrinsic motivation inventory.* Retrieved on 11/7/07 from http://www.psych.rochester.edu/SDT/.

Salomon, G. & Globerson, T. (1989). When teams do not function the way they ought to. *International Review of Educational Research, 13,* 88-99.

Sansone, C., & Smith, J.L. (2000). Interest and self-regulation: The relation between having to and wanting to. In C. Sansone & J.M. Harackiewicz (Eds.). *Intrinsic and extrinsic motivation: The search for optimal motivation and performance*. San Diego, CA: Academic Press.

Sawyer, K. & Berson, S. (2004). Study group discourse: How external representations affect collaborative conversation. *Linguistics and Education, 15,* 387-412.

Schwarzer, R., Diehl, M., Schmitz, G. (1999). *Self-regulation scale.* Retrieved on 11/7/07 from http://www.ralfschwarzer.de/.

Schierfele, U. (1992). Topic interest and evels of text comprehension. In K.A. Renninger, S. Hidi, and A. Krapp (Eds.), *The role of interest in learning and development* (pp. 151-182). Hillsdale, NJ: Lawrence Erlbaum Associates.

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology, 82,* 498-504.

Schommer, M., Crouse, A., & Rhodes, N. (1992). Epistemological beliefs and mathematical text comprehension: Believing it is simple does not make it so. *Journal of Educational Psychology, 84,* 435-443.

Schunk, D. H. (1981). Modeling and attributional effects on children's achievement: A self-efficacy analysis. *Journal of Educational Psychology, 73*, 93-105.

Schunk, D. H. (1983). Progress self-monitoring: Effects on children's self-efficacy and achievement. *Journal of Experimental Education, 51,* 89-93.

Schunk, D. H. (1987). Peer models and children's behavioral change. *Review of Educational Research, 57,* 149-174.

Schunk, D. (1994). Self-regulation of self-efficacy and attribution in academic settings. In D. H. Schunk & B. J. Zimmerman (Eds). *Self-regulation of learning and performance: Issues and educational applications* (pp. 75-99). Hillsdale, NJ: Lawrence Erlbaum.

Schunk, D. H. (1998). Teaching elementary students to self-regulate practice of mathematical skills with modeling. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp. 137-159). New York: Guilford.

Schunk, D. (2001). Social cognitive theory and self-regulated learning. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives (2nd ed.)*, (pp. 125-151). Mahwah, NJ: Erlbaum

Schunk, D. H., & Gunn, T. P. (1986). Self-efficacy and skill development: Influence of task strategies and attributions*.* *Journal of Educational Research, 79,* 238-244.

Schunk, D. H., & Rice, J. M. (1991). Learning goals and progress feedback during reading comprehension instruction. *Journal of Reading Behavior, 23, 351-364.*

Schunk, D. H., & Swartz, C. W. (1993). Goals and progressive feedback: Effects on self-efficacy and writing achievement. *Contemporary Educational Psychology, 18,* 337-354.

Schunk, D. & Zimmerman, B. (2007). Influencing children's self-efficacy and self-regulation of reading and writing through modeling. *Reading & Writing Quarterly, 23,* 7-25.

Schunk, D. H., & Zimmerman, B. J. (Eds.). (2008). *Motivation and self-regulated learning: Theory, research, and applications*. New York: Lawrence Erlbaum Associates.

Schwarzer, R. (1999). General perceived self-efficacy in 14 Cultures. Self-Efficacy assessment Retrieved on 12/8/08 from http:/www.yorku.ca/faculty/academic/schwarze/world14.htm.

Seiler, G. & Butler, L. (2005). Organizational mediation of urban science. In K. Tobin, R. Elmesky & G. Seiler (Eds.) *Improving urban science education: New roles for teachers, students, and researchers*. Lanham, MD : Rowman & Littlefield Publishers

Snijders, T., & Bosker, R. (1999). Multilevel analysis: An introduction to basic and advanced multilevel modeling. London: Sage Publications.

SPSS Inc. (1999). SPSS Base 10.0 for Windows User's Guide. Chicago, IL: SPSS Inc.

Spybrook, J., Raudenbush, S.W., Liu, X., Congdon, R., & Martínez, A. (2008). Optimal Design for longitudinal and multilevel research: Documentation for the "Optimal

Design" *software.* New York: William T. Grant Foundation. Retrieved January 14, 2009, from http://sitemaker.umich.edu/group-based/files/od-m anual-20080312-v176.pdf.

Stevens, J. (2002). *Applied multivariate statistics for the social sciences* (4th ed.). Mahwah, NJ: Lawrence Erlbaum.

Turner, J. C. (1995). The influence of classroom contexts on young children's motivation for literacy. *Reading Research Quarterly, 30*, 410-441.

Turner, J. C. (2005). Measuring self-regulation: A focus on activity. *Educational Psychology Review, 18,* 293-296.

Turner, J. C., & Patrick, H. (2004). Motivational influences on student participation in classroom learning. *Teachers College Record, 106,* 1759-1785.

Vygotsky, L. S. (1962). *Thought and language.* Cambridge, MA: MIT press.

Webb, N. M. (1991). Task-related verbal interaction and mathematics learning in small groups. *Journal for Research in Mathematics Education, 22*(5), 366-389.

Webb, N. M. (1992). Testing a theoretical model of student interaction and learning in small groups. In R. Hertz-Lazarowitz & N. Miller (Eds.), *Interaction in cooperative groups: The theoretical anatomy of group learning* (pp. 102-119). New York: Cambridge University Press.

Webb, N. M., & Farivar, S. (1994). Promoting Helping Behavior in Cooperative Small Groups in Middle School Mathematics. *American Educational Research Journal, 31*(2), 369-395.

Webb, N. M., Nemer, K. M., Chizhik, A.W.,&Sugrue, B. (1998). Equity issues in collaborative group assessment: Group composition and performance. *American Educational Research Journal*, *35*(4), 607–651.

Webb, N. W., Nemer, K. M., & Ing, M. (2006). Small-group reflections: Parallels between teacher discourse and student behavior in peer-directed groups. The Journal of the Learning Sciences, 15(1), 63–119

Webb, N. M., & Palincsar, A. S. (1996). Group processes in the classroom. In D. Berliner & R. Calfee (Eds.), *Handbook of Educational Psychology* (pp. 841-873). New York: Macmillan.

Webb, N. M. with Weishaupt, L. (Fall, 1998). Preparing students for collaborative work. *Connections.* Urban Education Studies Center, Seeds University Elementary School, UCLA.

Weiner, B. (1992). *Human motivation: Metaphors, theories, and research.* Newbury, Park, CA: Sage Publications.

Weiner, B. (1994). Integrating social and personal theories of achievement striving. *Review of Educational Research, 64,* 557-573.

Weiner, B. (2000). Intrapersonal and interpersonal theories of motivation from an attributional perspective. *Educational Psychology Review, 12,* 1-14.

Weinstein, C. E., & Mayer, R. E. (1986). The teaching of learning strategies. In M. Wittrock (Ed.), *Handbook of research on teaching* (pp. 315-327). New York: Macmillan.

Weinstein, C.E., Palmer, D.R., & Schulte, A.C. (1987) *Learning and Study Strategies Inventory*. Clearwater, FL: H&H Publishing.

Wharton-McDonald, R., Pressley, M., Rankin, J., Misteretta, J. (1997). Effective primary grades literacy instruction equals balanced literacy instruction. *The Reading Teacher, 50,* 518-521.

Wigfeild, A. (2000). The role of children's achievement values in the self-regulation of their learning outcomes. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-regulation of learning and performance: Issues and educational application* (pp. 101-124). Hillsdale, NJ: Lawrence Erlbaum.

Wigfield, A., & Eccles, J. S. (2002). The development of competence beliefs and values from childhood through adolescence. In A. Wigfield & J.S. Eccles (Eds.), *Development of achievement motivation* (pp. 92-120). San Diego, CA: Academic Press.

Wigfield, A., Eccles, J. S., Schiefele, U., Roesner, R., & Davis-Kean, P. (2006). Development of achievement motivation. In W. Damon & R. M. Lerner (Eds.), Handbook of child psychology (6th ed., pp. 933-1002). Hoboken, NJ: John Wiley.

Winne, P.H. (1995). Inherent details in self-regulated learning. *Educational Psychologist, 30*, 173-187.

Winne, P. H. (2001). Self -regulated learning viewed from models of information processing. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self- Regulated learning and academic achievement: Theoretical perspectives.* (2nd ed., pp. 153-189). Mahwah, NJ: Lawrence Erlbaum.

Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated engagement in learning. In D. Hacker, J. Dunlosky, & A. Graesser (Eds.), *Metacognition in educational theory and practice* (pp. 277-304). Hillsdale, NJ: Lawrence Erlbaum.

Winne, P. H. & Hadwin, A. F. (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky, A. C. Graesser (Eds.). *Metacognition in Educational Theory and Practice* (pp. 277-304). Mahway, NJ: Erlbaum.

Winne, P. H., & Jamiesson-Noel, D. L. (2002). Exploring students' calibration of self-reports about study tactics and achievement. *Contemporary Educational Psychology, 27*, 551-572.

Winne, P. H., & Perry, N. (2000). Measuring self-regulated learning. In M. Boekaerts, P. R. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation*. San Diego, CA: Academic Press.

Wolters, C. A., & Pintrich, P. R. (1998). Contextual differences in student motivation and self-regulated learning in mathematics, English and social studies classrooms. *Instructional Science, 26*(1-2), 27-47.

Wolters, C., Pintrich, P., Karabenick, S. (March, 2003). Assessing academic self-regulated learning. Paper presented at the conference on Indicators of Positive Development, Washington, D.C.

Wolters, C., Pintrich, P., & Karabenick, S. (2005). Assessing academic self-regulated learning. In K. Moore & L. Lippman (Eds.), What do children need to flourish? Conceptualizing and measuring indicators of positive development (pp.251 - 270). New York: Springer.

Yackel, E., Cobb, P., & Wood, T. (1991). Small-group interactions as a source of learning opportunities in second-grade mathematics. *Journal for Research in Mathematics Education, 22*(5), 390-408.

Yamauchi, H. & Tanaka, K. (1998) Relations of autonomy, self-referenced beliefs, and self-regulated learning among Japanese children. *Psychological Reports, 82,* 803-816.

Yowell, C.M. & Smylie, M.A. (1999). Self-regulation in democratic communities. *The Elementary School Journal. 99*(5), 469.

Zimmerman, B. J. (1989). Models of self-regulated leaning and academic achievement. In B. J. Zimmerman & D. Schunk (Eds.), *Self-regulated learning and academic achievement: Theories, research, and practice* (pp. 1-25). New York: Springer-Verlag.

Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: An overview. *Educational Psychologist, 25,* 3-17.

Zimmerman, B. J. (2000). Attaining self-regulation: A Social Cognitive Perspective. In M. Boekaerts, P. R. Pintrich & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13-39). San Diego, CA: Academic Press.

Zimmerman, B.J. (2002). Becoming a self-regulated learner: An overview*. Theory Into Practice*, *41*, 64-70

Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Educational Research Journal, 45,* 166-183.

Zimmerman, B. J., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal, 31,* 845-862.

Zimmerman, B. J., & Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment. *American Educational Research Journal, 31*, 845-862.

Zimmerman, B. J. & Cleary, T. J. (2006). Adolscence development of personal agency: The role of self-efficacy beliefs and self-regulatory skill. In B. J. Zimmerman & T. J. Cleary (Eds.), *Adolenscence and Education.* (pp. 45-69). Greenwich, CT: Information Age Publishing.

Zimmerman, B. J. & Kitsantas, A. (1997). Developmental phases in self-regulation: Shifting from process to outcome goals. *Journal of Educational Psychology, 89,* 29-36.

Zimmerman, B. J. & Kitsantas, A. (1999). Acquiring writing revision skill: Shifting from process to outcome self-regulatory goals. *Journal of Educational Psychology, 91,* 1-10.

Zimmerman, B. J. & Martinez-Pons, M. (1988). Construct validation of a strategy model of student self regulated learning. *Journal of Educational Psychology, 80,* 284-290.

Zimmerman, B. J., & Ringle, J. (1981). Effects of model persistence and statements of confidence on children's self-efficacy and problem solving. *Journal of Educational Psychology, 73*, 485-493.

Zimmerman, B.J. & Schunk, D. H. (2008). Motivation and self-regulated learning: Theory, research, and applications. Mahwah, NJ: Lawrence Erlbaum Associates

APPENDIX A

Self-Regulated Learning Survey

DIRECTIONS: I am going to read you some statements, and I would like you to circle the choice that best describes HOW OFTEN YOU DO what the statement says. Your choices include:

4 All of the time (4)

3 Most of the time

2 Sometimes

1 Never

1. Each day I read our plans carefully before I began working on our project.
2. I was able to work on our project for the whole period without being distracted.
3. I was often bored when we worked on our project, so I didn't finish what I was supposed to do.
4. At the end of each day I made sure I left enough time to plan for the next day.
5. Before I started working on our project I would read over our plans for the day.
6. I made sure I understood before we moved on to the next part of our project.
7. I used information I learned about in other classes in our project.
8. I double-checked my work to make sure I was doing it right.
9. I worked hard on our project even if I didn't like all the parts.
10. I stuck to our planned schedule for completing our project.
11. When our group planned, I made sure our plans were realistic.
12. I paid attention to and knew the purpose of what I was working on.

13. I gave up quickly when I couldn't find information I needed for my research.
14. I helped manage my time efficiently, so I was not rushing around to finish at the last minute.
15. I made sure the number of plans our group set for the day was manageable.
16. I helped make charts, diagrams, or outlines for our project.

APPENDIX B

Coregulated Learning Survey

DIRECTIONS: I am going to read you some statements, and I would like you to circle the choice that best describes HOW OFTEN YOUR GROUP DOES what the statement says. Your choices include:

4 All of the time (4)

3 Most of the time

2 Sometimes

1 Never

1. Each day we read our plans carefully before we began working on our project.
2. In our group we looked over each other's work to see if we understood what each member was doing.
3. We used more than one resource when we researched information for our project.
4. In our group we checked each other's work to make sure each other's research is correct.
5. We were able to work on our project for the whole period without being distracted
6. Our group was often bored when we worked on our project, so we often didn't finish what we were supposed to do.
7. At the end of each day, we left enough time to plan for the next day.
8. Before we started working on our project our group would read over our plans for the day.

9. We made sure everyone understood before we moved on to the next part of our project .
10. We applied information we learned about in other classes in our project.
11. We double-checked each other's work to make sure we were all doing it right.
12. If someone in our group became distracted, we were able to refocus everyone's attention back on our project.
13. We worked hard on our project even if we didn't like all the parts.
14. Our group stuck to our planned schedule for completing our project.
15. When we planned, we talked about if our plans were realistic.
16. In our group we all paid attention to and knew what each other was working on.
17. We used other resources besides Wikipedia in our research.
18. Our group did other things when we are supposed to be working on our project ®.
19. We gave up quickly when we couldn't find information we needed ®.
20. We managed our time efficiently so we were not rushing around to finish at the last minute.
21. We made sure the number of plans we set for the day was manageable.
22. In our group, one group member knew what another one was working on.
23. We used charts or diagrams in our project.
24. Members of our group were often distracted, which got in our way to work well on our project ®.

APPENDIX C

Motivational Orientations Survey

DIRECTIONS: Read each statement below and circle HOW OFTEN you do what the item describes. Your choices include always (4), most of the time (3), some of the time (2), or never (1).

1. I believe I can accomplish anything taught in my classes.
2. I prefer to do class work that is familiar to me, rather than work I would have to learn how to do.
3. I want to do better than other students in my class.
4. I am able to do my class work.
5. I enjoy class work that I learn from even if I look stupid .
6. I prefer to do class work as I have always done it, rather than trying something new.
7. I try to connect the material I learn in class with something I like doing or find interesting.
8. I like class work I can learn from even if I make a lot of mistakes.
9. I like class work that makes me think.
10. I can do my class work even if there are distractions.
11. Even if the work is hard, I can learn it.
12. I like class work that is familiar to me, rather than new material.
13. I try to make the information in class seem more useful by relating it to what I like to do.

14. I work hard even when class work is difficult because I am learning.

15. I choose class work that I know I can do, rather than work I haven't done before.

16. I make an effort to relate what we learn in class to my interests.

17. I do my class work is because I like to learn.

18. I do my class work because I am interested in it.

APPENDIX D

Task Features Survey

Directions: I am going to read you some statements and I would like you to circle the choice that best describes IF YOU AGREE OR DISAGREE WITH what the statements says. Your choices include:

4 STRONGLY AGREE

3 AGREE

2 DISAGREE

1 STRONGLY DISAGREE

Ok, let's get started.

1. I think our project was interesting to learn about.
2. I worked hard on our project.
3. I put a lot of effort into working on our project.
4. I believe I had a choice about the topic we picked for our project.
5. Some things that I learn in school help me do things better outside of class; that is, they are useful. For example, learning about plants might help me grow a garden. In general, I feel the information I learned from working on our project is useful outside of school.
6. I feel everyone in my group played an important part in our project.
7. I enjoyed working on our project.
8. I think our project was too hard.
9. I tried very hard to do well our project.

10. I played a role in choosing our project.
11. I felt like I could really depend on the people in my group.
12. I am still interested in our project.
13. We were able to complete our project on time.
14. I worked hard on our project.
15. I felt like I had no choice in which topic my group chose for our project ®.
16. I think our project is an important activity.
17. I feel like our group really worked together as a team.
18. I think our project was boring.
19. I feel like I did all the work on our project by myself with little help from my group members.
20. I feel that the students in my group listened to each other.

APPENDIX E

Final Project Assessment

Rubric

Teacher: Sulu
Group: 1

Final Project Rubric

CATEGORY	3	2	1
Topic - Creative	The project idea is exceptionally creative and the products students made are also creative	The project idea is not exceptionally creative but students products reflect creativity	The project shows no signs of originality or creativity
Content - Accuracy	Students research is accurate and thorough	Students research has one or two missing gaps	Students research is not accurate and contains numerous holes
Graphics - Relevance	If students included graphics in their poster (voluntary) they are relevant to the project	Some graphics students included are not relevant to the project	Graphics are included haphazardly and do not align with project
Organization	PowerPoint slides are clear and organized	PowerPoint slides are clear but lack organization	Slides lack organization and clarity
Knowledge Gained	Student can accurately answer all questions related to facts in the poster and processes used to create the poster.	Student can accurately answer most questions related to facts in the poster and processes used to create the poster.	Student can accurately answer about 75% of questions related to facts in the poster and processes used to create the poster.
Skills	Students used a number of core content area skills in their project	Students used 1 or 2 content area skills in their project	Project does not reflect the use of any skills
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout and neatness.	The poster is acceptably attractive though it may be a bit messy.
Mechanics	Capitalization and punctuation are correct throughout the poster.	There is 1 error in capitalization or punctuation.	There are 2 or more errors in capitalization or punctuation.

2. Please rank students project in your class (1 best to 4 worst). Circle the appropriate rank for this group

1 2 3 4

APPENDIX F

Instruction for the Collaborative Collage Assignment

Collaborative Collages

Goals

1. To identify and illustrate your shared interests as a group..
2. To practice communication and cooperation skills.

Directions

1. Look through magazines and choose pictures of things that interest you.
2. Ask group members if they are interested in the picture you chose.
3. If yes, cut the picture out.
4. If no, move on to another picture.
5. As you gather pictures, try to come up with a theme (or two) that represents the photos you have chosen.
6. When you have gathered enough pictures to fill your poster paper, begin to arrange your photos on the paper. Remember to include labels on your poster paper to help us guess your theme.
7. Be prepared to answer questions about your group theme, including:
   a. What is your theme?
   b. Why did you choose this theme?
   c. How could you develop this theme into a project?

APPENDIX G

I have a Theme, Now What Worksheet

I've Got A Theme! Now what...

Add more 2/21/08

Here is the fun part…its time to plan our projects!!

1. Our theme(s) is/are 1) Soccer
   2) ____________________

2. We want to… (circle as many as you like)

DESIGN - Design the uniform

EXPLORE

BUILD

a fabric experiment to see the best quality

RESEARCH

Research contract and cloth info. Players stats/players

COMPARE/CONTRAST

compare prices

two different cloths/fabrics

SAVE SOMETHING

ANALYZE

soccer contracts

USE - fabrics, cloth, internet, books

LEARN MORE ABOUT

Learn more about products and staff.

MAKE - a soccer team, Chart of Stats! 2/21/08

INVENT

START

3) Tell me how the words you circled relate to your theme! Fill in the blank for EACH word you circled above.

Example: If I circled "create" above and my theme was fashion.

We want to CREATE a NEW CLOTHING LINE

YOU TRY!!

1. We want to Design (insert circled word) a uniform
2. We want to research (insert circled word) a contract and cloth info
3. We want to analyze (insert circled word) a soccer contracts
4. We want to use (insert circled word) a fabrics, cloth, internet, books
5. We want to compare/contrast (insert circled word) a cloth/fabric

APPENDIX H

Project Description Worksheets

OUR PROJECT DESCRIPTION

1. WHAT YOU ARE GOING TO DO???? **Make sure to include everything you circled on the first two pages!**

2. A goal is something our group wants to accomplish at the end of this project. For example, one goal might be “I want to create a new company.” List five goals you have for your project.

1.

2.

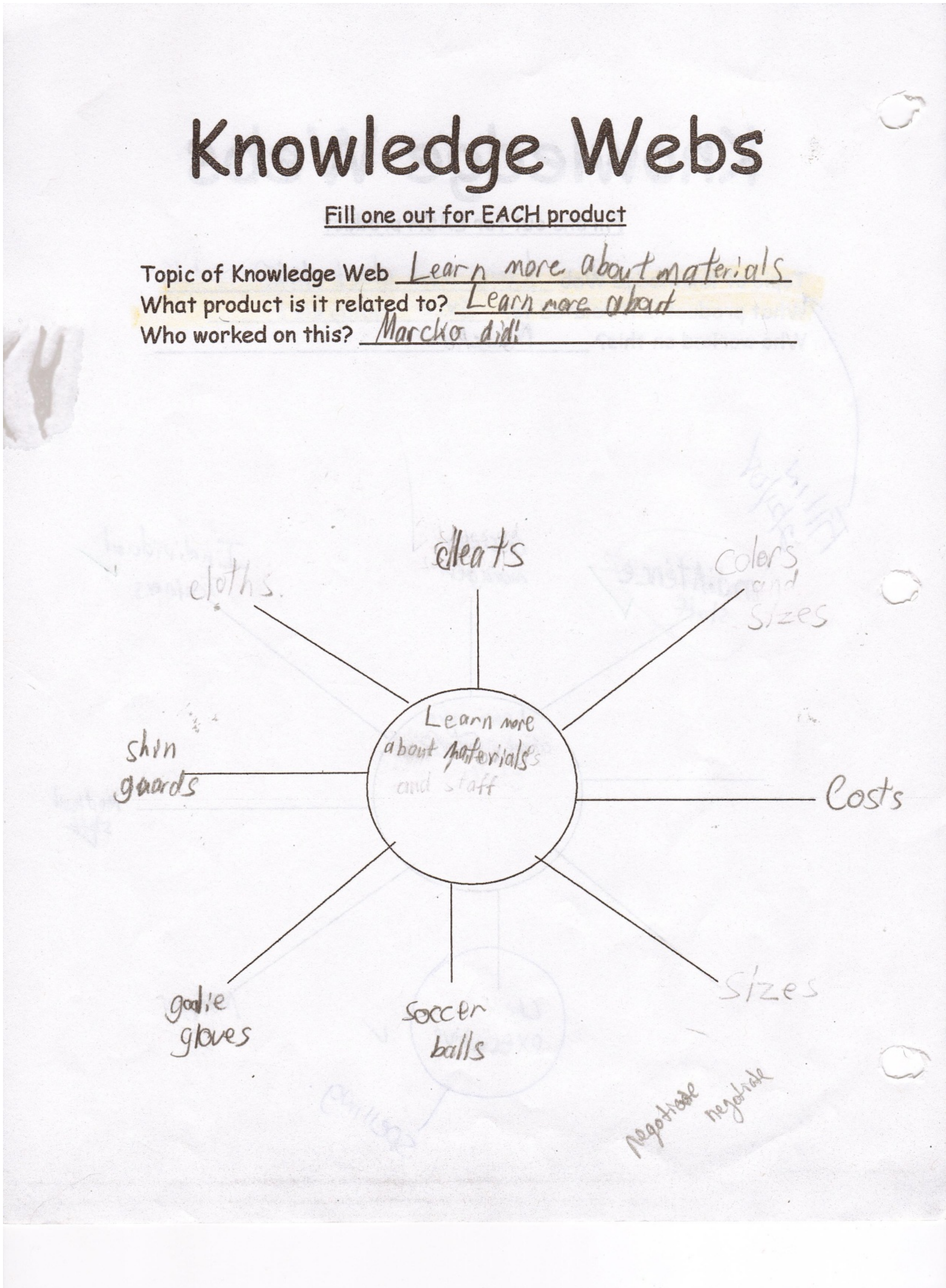
3.

4.

5.

APPENDIX I

An Example of a Knowledge Webb


Knowledge Webs

Fill one out for EACH product

Topic of Knowledge Web Learn more about materials
What product is it related to? Learn more about
Who worked on this? Marcko did!

APPENDIX J

An Example of a Research Page

RESEARCH

Fill one out for every piece of information you need to know

DATE 3/13/08

What am I researching? goalie gloves

The research relates to which part of my project? materials

Who worked on this? Gina and Marcko

What sources did you use? www.google.com

Research (what did you find?):

The best goalie gloves are latex foam galie gloves. For years, latex foam materal has been adopted as the standard surface materia for use within the palm of the goalie glove due to the high coefficient of friction relative to the balls' plastic surface as well as it's high damping characteristics

How will I use this information in my project?

We will use this information by putting or giving the certain material gloves; to our goalie.

APPENDIX K

Daily Calendar Pages

DAILY THINGS TO DO

Task	Who is responsible?	Completed?
1.		
2.		
3.		
4.		
5.		
6.		
7.		

APPENDIX L

Weekly Calendar Pages

WEEKLY SCHEDULE

Group # _______________Week of _______________________________

MONDAY	
TUESDAY	
WEDNESDAY	
THURSDAY	
FRIDAY	

APPENDIX M

Coding Scheme

Code	Types	Definition and Examples of Individual Regulation	Definition and Examples of Coregulation
Planning	Product Planning		
	Product planning involved defining the scope of the project and identifying its goals.	"I want to make a car for my project."	"We're going to make, guys we're going make like own kind of car I guess. Right?"). (idea generation)
	Process planning		
	Assigned group roles or decided the order in which they would complete tasks relating to a project idea	"I found wheels and tires and now I'll look for machinery."	"Nobody has done this. Do the products. Do el products, do products."
Monitoring	Task Monitoring:		
	Monitored the status of the tasks they created through process planning	To herself: "Ok, Gabrielle, you finished the knowledge web on contracts, now what are you supposed to do? Uh, Uh. *(*Gabrielle *thinks for a second)* Research players' stats. Henry, can you give me another knowledge web thingie for players stats?"	"Who is researching stegosaurus?"

	Content Monitoring		
	Monitored their own and each other's ideas, research, and/or problem-solving related to the content of their projects	"Where's the cost? Where's the cost? I can't find the cost! Oh, there it is. Oh, there's the cost."	"Wait, what did you have? What do you have on players' stats in there?"
Evaluation	Content Evaluation		
	Statements aimed to assess or judge content related to their project	"Bran Enterprise's car is more fuel efficient because it uses solar energy to power the M2JC, no that's not right, it's solar and hydrogen energy. Bran Enterprise's car is more fuel efficient because it uses solar and hydrogen energy to power the M2JC."	"Alright, you just need to like you don't need a second outline this one is fine the way it is."
	Mechanics Evaluation		
	Assessing and correcting formatting, spelling, grammar, or punctuation errors	"Opps, that's wrong. It should be a period there, not a comma."	"No, that's not a word. It's worse"
Regulating Behavior	Effort/ Attention		
	Strategies to focus one's own or other's effort or attention on the task at hand	"Alright, alright, focus."	"Alright let's go back to this."

Regulating Motivation	Praise/ Encouragement		
	Statements to commend oneself or another group member	"I got this."	"Man, that's awesome! You're workin' now."
	Agreement/ Understanding		
	Statements to express agreement or understanding		"I get you."
	Self-efficacy Talk		
	Statements to express confidence that oneself or others can accomplish a particular task	"I know I can do this."	"Yeah, focus, you can do it."
	Relevance		
	Statements to express how important something is to the task	"Learning this is important because I can use it…"	"You should look for cheaper metals or anything like that 'cause that would really help us on our project."
	Interesting		
	Statements to express how interesting or cool an aspect of the task is	"I like looking up stuff about (blank) it interesting."	"That is so cool,.
	Performance (Extrinsic)		
	Statements to link the own or group's performance to an external standard (e.g. a grade)	"I need an A, so I gotta' finish this."	"Come on, if we don't finish this we are gonna' fail."

Negative Self-efficacy		
Statements that indicate lack of confidence in own or other’s ability to perform a task	“I don’t understand this, I can’t do it.”	“There is no way you can calculate that in your head.”
Verbal Putdown		
Criticizing statements	“I suck.”	“You suck, you know.”

CURRICULUM VITA

Nicole C. DiDonato

Academic Degrees

2009	Doctor of Philosophy Graduate School, Rutgers University, New Jersey Major Area of Study: Education
2008	Master of Education Graduate School of Education, Rutgers University, New Jersey Major Area of Study: Learning, Cognition, and Development
2003	Bachelor of Science Rutgers College, Rutgers University, New Jersey Major Area of Study: Accounting

Principal Occupations

2008 - 2009	Teaching Assistant, Graduate School of Education, Rutgers University, New Jersey
Summer 2007, 2008	Instructor, Graduate School of Education, Rutgers University, New Jersey
2004 - 2008	Graduate Assistant, Graduate School of Education, Rutgers University, New Jersey
2003 - 2004	Auditor, Johnson & Johnson Company, New Jersey

Publications

DiDonato, N. C. & O’Donnell, A. M. (under review) Information technology students’ beliefs of educational and career choices.

McInernery, C., DiDonato, N. C., Giagnacova, R., & O’Donnell, A. M. (2007). Students’ choice of information technology majors and careers: A qualitative approach. *Information Technology, Learning and Performance Journal, 24,* 35-53.

O'Donnell, A. M., & DiDonato, N. C. (2007). A tale of two formats. *Proceedings of the 8th Computer Supported Collaborative Learning Conference.*

DiDonato, N. C., & O'Donnell, A. M. (2006). Factors that influence IT students' choice of IT majors and careers. *Proceedings of the International Biennial SELF Research Conference, USA, 4*, 1-7.