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LEARN 2 LEARN: A Metacognitive Intervention for Middle School

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Abstract

Self-regulated learning is comprised of motivation, cognition, and metacognition. This study aimed to improve eighth grade social studies students' self-regulated learning and academic performance through the implementation of an intervention into their social studies curriculum. The intervention centered on exposing students to the different dimensions of metacognition (i.e., comprehending and being able to control one's own cognitive processes) based on research findings that showed a link between metacognition and academic performance (Dignath & Büttner, 2008; Kistner, Rakoczy, Otto, Dignath-van Ewijk, Büttner, & Klieme, 2010). The intervention was designed to foster the students' knowledge and use of metacognitive strategies through group work and cognitive discussions based on the research by Paris and Paris (2001). Four eighth-grade history sections taught by one teacher and two sections taught by a second teacher participated in the study. Three sections were randomly assigned to the intervention group and the other three to the control group. All students completed pre- and post-testing quantitative measures of metacognition and motivation. Teachers rated students' ability beliefs and their levels of metacognition at post-testing. In addition, student performance was evaluated in terms of overall changes in grades from the first to third marking period. As predicted, the experimental group showed more improvement than the control group at post-testing in terms of their levels of metacognition. There was no effect of the intervention on the students' academic performance or motivation; however, all the quantitative measures of metacognition and motivation were positively correlated with quarterly grades. Furthermore, the quantitative measure of metacognition developed for the present program of research was found to be a better predictor of grades than a widely used measure of metacognition (Sperling, Howard, Miller, & Murphy, 2002).

Introduction

Self-Regulated Learning

Self-regulated learning (SRL), an individual's ability to comprehend and control his/her own learning, encompasses one's cognition, metacognition, and motivation (Schraw, Crippen, & Hartley, 2006). Schraw et al. (2006) emphasize that while distinct, these three components of self-regulated learning are highly interdependent. Butler and Winne (1995) state that self-regulation is inherent to effective learning. Greater self-regulatory ability enhances students' awareness of "the qualities of their own knowledge, beliefs, motivation, and cognitive processing-elements" (p.245).

According to Schraw et al. (2006), cognition encompasses simple cognitive, problem-solving, and critical thinking strategies. Metacognition, which refers to reflecting and directing one's own thinking, is often divided into two components of cognition: knowledge and regulation. Knowledge of cognition can be subdivided into: (1) *declarative*, which refers to knowing one's characteristics as a learner, and in relation to performance, (2) *procedural*, denoting cognizance of one's own repertoire of learning strategies, and (3) *conditional*, which relates to knowing why and when to use specific strategies (Schraw, 1998). On the other hand, regulation of cognition encompasses the processes of planning, monitoring, and evaluating. *Planning* refers to strategy selection and resource distribution in the learning setting. *Monitoring* denotes all the steps taken to supervise one's performance throughout learning tasks, and *evaluating* consists of all processes of self-appraisal in regards to learning goals and gains (Schraw et al., 2006).

McCombs and Marzano's (1990) theoretical framework of self-regulated learning highlights the importance of the self as an active agent in the integration of these multiple

dimensions. They argue that while self-regulation is an intrinsic aspect of development, an individual's determination and self-concept are crucial in initiating and maintaining self-regulatory learning processes. Furthermore, they claim that self-development is compromised when there is a lack of metacognitive understanding due to the disconnection between the individual and his/her own cognitive processes (McCombs & Marzano, 1990). Thus, metacognitive awareness is said to operate as a key component in helping an individual successfully integrate the different realms of self-regulated learning, while also improving one's sense of self-efficacy (McCombs & Marzano, 1990).

In contrast, Butler and Winne (1995) single out monitoring as the central element of self-regulated learning. According to them, monitoring provides individuals with continuous internal feedback that directly affects their cognitive engagement with tasks. Zimmerman (1995) argues that Butler and Winne's (1995) model of self-regulated learning falls short in accounting for learners' most common self-regulatory failures. He suggests that self-regulated learning should be understood as a complex interactive process involving metacognitive awareness and ability, motivation, and behavioral processes, all of which are affected by the learner's context.

In relation to classroom performance, self-regulated learning has been linked to students' (1) metacognitive strategies, (2) control and management of effort, (3) cognitive skills, and (4) motivation (Pintrich & DeGroot, 1990). They argue that the general expectancy-value model is applicable to the motivational component of learning. This model states that motivation to learn results from one's expectancies, values, and affective state regarding a specific academic task. Expectancies denote individuals' beliefs about their ability to successfully complete a task (i.e., self-efficacy). Values refer to the level of interest and degree of importance that a student places

on a learning task. Lastly, the affective component of the model is comprised of the emotional reactions to a task (e.g., test anxiety).

The fact that effective learners are able to maintain self-regulated learning behaviors even under negative affect or when they have a lack of interest in a topic confirms the significance of motivation's role in the learning process (Metallidou & Vlachou, 2010). Self-efficacy and personal agency appear to be some of the most relevant motivational aspects related to self-regulated learning (Carns, 1991; Bandura, 1997; Schraw et al., 2006; Zimmerman, 1995).

Self-Regulated Learning Interventions

McCombs and Marzano (1990) assert that interventions aiming at fostering self-regulated learning should focus on the development of metacognitive awareness. According to them, improvements in the latter component allow individuals to remain motivated and to cultivate the necessary self-regulatory skills. Furthermore, effective interventions should target both the learner and the learning environment (McCombs & Marzano, 1990). In addition to enhancing cognitive and metacognitive abilities, interventions need to be tailored to match the learner's needs, areas of interest, and personal goals (Carns, 1991).

McCombs and Marzano (1990) stress the importance of reinforcing the idea that individuals "[are] creative agents with the power of choice" (p.63). Accordingly, self-regulated learning interventions should endorse learners' autonomy in order to enhance the parallel improvements of their self-regulatory mechanisms and self-efficacy (Deci & Ryan, 2008). An effective learning environment should consistently provide positive social and emotional support and reinforce the value of learning along the process of skill acquisition (McCombs & Marzano, 1990).

Given the challenge in ensuring that all individuals are exposed to positive learning environments at home, researchers have stressed the significant benefits that would result from cultivating self-regulated learning within the schooling system (McCombs & Marzano, 1990). While a restructuring of the education system is unrealistic, research proposes a range of methods aimed at promoting the development of self-regulatory skills in the academic setting. Self-assessment is one of the many useful tools that can easily be incorporated into school curricula and SRL interventions (McCombs & Marzano, 1990). Self-assessment provides the learner with an autonomous way to self-evaluate (i.e., gain metacognitive awareness), without exposure to external judgment that could hinder the learner's motivation and/or self-concept (Joseph, 2009).

Pintrich and De Groot (1990) conducted a study with seventh grade science and English students. They found that cognitive strategy use, self-efficacy, and intrinsic value were positively correlated with self-regulation. Furthermore, self-regulation was found to be the best predictor of academic performance. Additionally, Pintrich and De Groot (1990) observed that students who valued learning per se (i.e., intrinsic value orientation) displayed significantly higher use of cognitive strategies. Based on these findings, the authors emphasized the importance of instructing students on different self-regulatory and cognitive strategies in order to see improvement in their academic performance (Pintrich & DeGroot, 1990).

Fuchs et al. (2003) conducted an intervention with third graders from an urban setting aimed at assessing the effects of self-regulated learning on problem-solving ability, specifically in mathematics. The intervention was time-intensive and had a relatively long duration; a total of 32 sessions were taught twice a week over the span of four months. The study focused on goal setting, self-monitoring, and self-evaluation. The authors found that (1) teaching cognitive skills

had a positive effect on academic performance, (2) combining cognitive and metacognitive skills led to even greater academic improvement, (3) self-regulated learning interventions had positive effects on learning regardless of the student's level of achievement.

Research has shown that students tend to show a motivational decline during their transition to middle school; exhibiting decreases in their self-esteem, task values, and intrinsic interest in the academic setting (Cleary & Zimmerman, 2004; Metallidou & Vlachou, 2010). Hence, Cleary and Zimmerman (2004) developed a training program for adolescents called "Self-Regulation Empowerment Program" (SREP). This intervention aimed to encourage positive motivational beliefs, increasing knowledge of learning strategies, and helping students apply these strategies in a cyclical, self-regulated manner (Cleary & Zimmerman, 2004). The SREP consisted of an assessment stage, followed by the actual training program with a self-regulated learning coach (SRC). During the assessment stage, the SRC analyzed the student's learning behaviors and determined his/her main strengths and weaknesses as a learner. Based on the observations, the training stage was tailored to work on the student's specific needs.

The SRC focused on enhancing a student's empowerment, encouraged continuous self-reflection, introduced effective learning strategies, provided feedback and guided practice of these skills, and instructed the learner on mechanisms of goal setting and self-evaluation. Cleary and Zimmerman (2004), argue that self-regulated learning's cyclical nature should be emphasized in effective SRL interventions. Self-sufficient learners exhibit mastery of the self-regulatory feedback loop, display higher levels of motivation, and demonstrate better academic achievement (Cleary & Zimmerman, 2004; Ambrose, Bridges, Lovett, DiPietro, & Norman, 2010).

Researchers recommend the implementation of several instructional strategies as ways to improve self-regulated learning in the classroom: (1) inquiry based learning (e.g., scaffolded instruction, explicit reflective thinking, process-oriented approach), (2) student-teacher collaboration, (3) strategy instruction (e.g. cognitive strategies, problem-solving, critical thinking), (4) mental models and conceptual change, (5) use of technology, and (6) promoting positive student and teacher beliefs about learning and self-efficacy (Schraw et al., 2006; Joseph, 2009). In incorporating these self-regulation promoting strategies, students will acquire a wide range of effective cognitive strategies, will gain metacognitive awareness, and will endorse more positive motivational beliefs (Schraw et al., 2006).

Kistner et al. (2010) conducted an observational study of self-regulated instruction of ninth grade math teachers in Germany. They discerned three types of teaching approaches: *implicit* (purpose of activities are not expressed to the students), *explicit* (purpose and importance of learning strategies are explained to the students), and *indirect* (teacher creates a learning environment that fosters self-regulatory skills). Kistner et al. (2010) found high variability in the degree and approach of self-regulated learning instruction among the teachers in their sample. Furthermore, they found that explicit instruction is the approach with the strongest positive link to gains in academic performance. However, they reported that explicit instruction rarely occurred, so they highlighted the importance of incorporating explicit instruction of self-regulated instruction in the classroom.

Metacognition

Flavell (1979) was one of the earliest researchers of the development of metacognition. His model laid the foundations for the evolution of a theoretical framework of metacognition, especially in suggesting its multifaceted nature. His model was one of the first to formulate that

metacognition is comprised of knowledge (i.e., an individual's database of knowledge about cognition) and experience (i.e., instances of thorough cognitive engagement, which can modify our metacognitive database and also affect our motivation and future strategy-use). Flavell (1979) suggested that individuals' ability to engage in and comprehend metacognition is contingent to their developmental stage.

Veenman, Van Hout-Wotter, & Afflerbach (2006) argue that metacognitive skills begin to emerge between ages 8 to 10 and continue to develop afterwards. While metacognitive knowledge and skills may be present in early school years, they become more refined with the inherent increase in academic demands that happens throughout development. Moreover, metacognitive skills tend to be domain-specific early on, but gradually become more generalized (Veenman et al., 2006; Schraw & Moshman, 1995).

Based on extant theory and research of metacognition, Ambrose et al. (2010) developed a cyclical model of self-directed learning. Their model consists of a cycle of distinct yet interdependent metacognitive steps that are constantly influenced by the learner's beliefs about intelligence and learning. This first step is "Assess the Task", which refers to a student's ability to understand what a task entails, as well as its purpose. Second, "Evaluate Strengths and Weaknesses" denotes an individual's ability to self-evaluate his/her knowledge and skills in relation to the task. Third, "Planning" pertains a student's ability to come up with a tactic to approach the task, prior to starting. Fourth, "Apply Strategies and Monitor Performance" signifies the enactment of the strategies and self-assessment of one's progress throughout the task. Last, "Reflect and Adjust as Needed" takes place upon completion of the task; it involves reflecting on one's performance through all the steps of the cycle and making the necessary amendments for future endeavors (i.e., re-starting the cycle).

Ambrose et al. (2010) assert that "to become self-directed learners, students must learn to assess the demands of the task, evaluate their own knowledge and skills, plan their approach, monitor their progress, and adjust their strategies as needed" (Ambrose et al., 2010, p.191). Joseph (2009) emphasized the importance of developing metacognitive awareness in order to effectively plan, regulate, and assess one's learning. She argued that current educational practices fail to foster intellectual maturity and self-regulated learning because they solely focus on skill acquisition. While skill acquisition is important, it is essential to know how, when, and why to use these skills, as well as having the motivation to do so (Carns, 1991; Metallidou & Vlachou, 2010). Very few students effectively self-regulate without direct instruction, practice, and encouragement (Joseph, 2009).

Schraw and Moshman (1995) devised a theoretical framework of metacognitive theories, which refer to distinct models that integrate an individual's metacognitive knowledge and experiences, and that elicit the comprehension and control of one's own cognitive processes differently. They argue that learning experiences and self-reflection allow individuals' metacognitive theories to gradually change over time. A *tacit theory* implies that the individual endorses this specific construct without awareness of doing so. Thus, their implicit nature makes them more resistant to modification even if they are incorrect and not conducive to effective learning. An *informal theory* implies that individuals have a degree of explicit metacognitive awareness but have not yet developed a complete theoretical framework, which hinders their ability to gain an overarching comprehension of their cognition. *Formal theories* represent "highly systematized and quantifiable accounts" of metacognitive phenomena, which grant an individual with full awareness, greater control over their self-regulation, and ability to modify their metacognition (Schraw & Moshman, 1995, p.361).

Explicit metacognitive theorizing enhances an individual's performance and his/her understanding of achievement (Schraw & Moshman, 1995). Furthermore, extant literature supports the notion that it is both possible and important to increase metacognition (especially in children), given its utility beyond the academic setting (Flavell, 1979; Cross & Paris, 1988; Ambrose et al., 2010; Veenman et al., 2006). Research shows that learners do not know when and how to adequately apply metacognitive skills, which confirms the demand and significance of explicitly instructing metacognition (Ambrose et al., 2010).

Effective Interventions

Hattie, Biggs, and Purdie (1996) conducted a meta-analysis of 53 studies to establish the characteristics of effective study skills interventions. They categorized interventions based on their focus (e.g., cognitive, metacognitive, affective), and their structure (e.g., *unistructural, multistructural, relational*). They found that *unistructural* interventions (i.e., based on a single relevant feature) had the strongest effect on performance. Programs involving a range of independent strategies that were not incorporated into the context (i.e., *multistructural*) had moderate success on performance, increased positive attitudes, but did not improve study skills. Interventions under the relational category systematically generated improvements across all outcomes (e.g., performance, attitudes, study skills). Moreover, *relational* metacognitive interventions taught within the academic curriculum and suited for specific tasks were found to be the most successful. In terms of age and ability, interventions were found to be most effective for young students (below college age) with moderate to low academic achievement. Hattie et al. (1996) suggested that interventions should take place in a context supportive of positive motivational values and metacognitive awareness, where the student is always actively involved in the learning process.

Dignath and Bütner (2008) conducted a more recent meta-analysis focused on the characteristics of self-regulated learning interventions aimed at improving academic performance, strategy use, and students' motivation in primary and secondary school. Their findings suggest that at primary and secondary schools, interventions are more effective when taught by researchers and when they have longer duration (i.e., higher number of sessions). Interventions at secondary school were found to generate increased strategy use and academic improvement in writing. Furthermore, secondary school training programs were more effective when (1) aligned with metacognitive learning theory, (2) the instruction was focused on motivational strategies and metacognitive reflection (as opposed to cognitive skill acquisition), and (3) incorporated group work (Dignath & Bütner, 2008).

Literature on classroom applications of self-regulated learning emphasizes the positive impact of cognitive engagement on the quality of students' learning (Ambrose et al., 2010; Paris & Paris, 2001). In discussing different approaches to enhance students' metacognition, Harvey (2002) advocated for the use of portfolios as an effective method to promote planning, reflection, self-evaluation, and autonomy. Effective interventions should involve activities that "elicit the intrinsic interests of students, permit a sense of ownership, relate to life outside of school, allow for collaboration, communicate high expectations, and offer consistent support for students to meet those expectations" (Paris & Paris, 2001, p.93). Paris and Paris (2001) also suggest that open-ended tasks and "project-based learning" represent good opportunities for students to engage in a meaningful and self-directed manner (p.94).

Theories of Intelligence and Academic Achievement

Implicit theories of intelligence claim there is a dichotomy in individuals' beliefs about the nature of intelligence; an *incremental theorist* believes that intelligence is a quality that can

be improved through effort and practice, while an *entity theorist* considers it to be a fixed and unchangeable trait (Dweck & Leggett, 1988). Individuals who endorse an incremental theory tend to focus on learning goals (aimed at improving their own ability), and they believe that exerting effort is worthwhile in order to accomplish a task. Furthermore, they tend "to make low-effort, mastery-oriented attributions for failure" and exhibit "mastery oriented-strategies" in responding to setbacks (Blackwell, Trezsniewski, & Dweck, 2007, p.247). On the other hand, entity theorists usually have performance goals (aimed at demonstrating their ability), find effort to be futile in improving an outcome, and endorse helplessness attributions and strategies whenever facing adversity in their goal-pursuit.

While individuals' intelligence beliefs are not directly linked with their intellectual capacity, they help to structure the way individuals approach academic challenge and thus have an effect on their performance in academic endeavors (Blackwell et al., 2007; Ambrose et al., 2010). Blackwell et al. (2007) conducted a longitudinal intervention study to explore the relation of intelligence beliefs and academic achievement. The longitudinal study looked at students in their transition from 7^{th} to 8^{th} grade. They found that having an incremental theory was positively linked to positive effort beliefs, learning goals, low helpless attributions, goal-mastery strategies, and higher academic achievement in math grades. The intervention aimed at instructing 7^{th} grade students on incremental theory over the span of 8 sessions. They found that the experimental group showed higher levels of motivation and became more incremental in their intelligence beliefs. Moreover, in terms of academic achievement, they found that a decline in grades was halted among the experimental group, whereas the control group continued to exhibit a downward trajectory.

Assessment of Self-Regulated Learning

Because self-regulated learning comprises multiple interdependent components, assessing it is a challenging task. The assessment of metacognition can consist of questionnaires, interviews, thinking-aloud protocols, observations, stimulated recall, computer log-file registration, and eye-movement registration (Veenman et al., 2006). While the different assessment methods inherently vary in terms of their benefits and drawbacks, it is still unclear what constitutes the most effective way to measure the different knowledge and skill components of metacognition. Veenman et al. (2006) argue that the only established difference across assessment methods relates to the timing or "line" of administration; "Off-line methods are present either before or after task performance, whereas on-line assessments are obtained during task performance" (p.9). Research findings support the notion that in measuring metacognition, on-line methods are better predictors than off-line methods of assessment (Veenman et al., 2006). This suggests that assessment of metacognition should preferably take place while a learner is engaging in an academic task, as opposed to before or after the fact.

Two of the most widely used and validated self-report measures of metacognition and self-regulated learning for adults are the Metacognition Awareness Inventory (MAI) (Schraw & Dennison, 1994) and the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia, & McKeachie, 1992). Sperling, Howard, Miller, Murphy (2002) developed the Junior Metacognitive Awareness Inventory (Jr. MAI) as a measure of children's metacognition from 3rd to 9th grade. The purpose of developing this measure was to evaluate and account for the effectiveness of metacognitive interventions, as well as gaining greater insight about the dynamics between the different components of self-regulated learning for children. They created two versions of the Jr. MAI, one version for 3rd to 5th grade students, and a second for 6th to 9th

graders. The authors conducted an experiment to examine the instrument's reliability and found that the Jr. MAI was a valid and reliable measure of metacognition.

Sperling et al. (2002) constructed the Jr. MAI based on the premise that metacognition is comprised of two components: (1) knowledge of and (2) regulation of cognition. Thus, their measure was designed and purported to assess these two distinct components of an individual's metacognition. However, other theoretical frameworks see metacognition as a more complex process that is cyclical and multifaceted in nature. Ambrose et al.'s (2010) model illustrates a 5-step cycle of metacognitive processes that learners go through when engaging in self-directed learning, along with the individuals' beliefs about intelligence and learning as influential factors throughout the cycle.

Given that this study's intervention is based on Ambrose et al.'s (2010) model, the Jr. MAI did not represent an adequate method to assess potential changes in the level of students' metacognition along the five distinct metacognitive steps. Thus, Naratil, Howe, Reuman, and Anselmi (2013) developed the Metacognition 5 (MC5), as a new measure of adolescents' metacognitive abilities aligned with Ambrose et al.'s (2010) theory of metacognition. For the current study, the measure was modified in terms of the number and wording of the items. The revisions aimed to further align the instrument with Ambrose et al.'s (2010) descriptions of the steps in the cycle of self-regulated learning, while still ensuring that the vocabulary and academic tasks remained relevant for middle school students.

The measure currently consists of 35 self-report items evenly distributed to assess the five steps of the aforementioned model of metacognition. In contrast to the two distinct dimensions that the Jr. MAI purports to measure, the revised MC5 assesses students' metacognition across five interdependent factors. The MC5 aims to provide a more detailed and

multifaceted assessment of students' metacognitive ability in the learning setting that also offers researchers with greater insight about specific areas of difficulty and helps to shape effective interventions.

Implications of Research

Researchers have emphasized the importance of self-regulation in the academic setting (McCombs & Marzano, 1990). Mastery of self-regulated learning and metacognition in particular leads to better learning quality and higher academic achievement (Ambrose et al., 2010). Although research has shown a strong link between metacognition and academic performance, academic institutions have not incorporated explicit metacognitive instruction into their curricula. Extant research has shown that metacognitive interventions can lead to increased metacognitive awareness and can be readily taught in the classroom (Dignath & Büttner, 2008). This suggests that researchers should collaborate with educators on the development of effective interventions for the classroom than can increase students' metacognition, have positive effects on their academic performance, and overall make them better learners.

Current Study

This study aimed to improve learning and academic performance in eighth grade classrooms by implementing a metacognitive intervention into the social studies curriculum. The intervention is based on Ambrose et al.'s (2010) cycle of self-regulated learning. The sessions were conducted in an interactive and supportive manner, involved group work, individual activities, and reflective discussions, which intended to foster the students' knowledge and use of metacognitive strategies. The content and language used in the sessions was chosen in accordance with 8th grade students' interests and developmental stage. The intervention emphasized the cyclical and interdependent nature of the 5-steps of the model, as well as the

importance of positive motivation values (e.g., self-efficacy, incremental intelligence beliefs) in self-regulated learning. While the intervention was primarily focused on improving students' metacognition, it was intended to have positive effects on motivation given the interdependent nature of both components in the context of learning.

Hypotheses

H1: The intervention would lead students in the experimental group to show more improvement in their metacognition (MC5 scores) than the control group.

H2: The intervention would lead students in the experimental group to exhibit more academic improvement than the control group.

H3: The Metacognition 5 (MC5) would be a better predictor of academic performance than the Junior Metacognitive Awareness Inventory (Jr. MAI).

H4: All measures of motivation would be positively correlated with academic performance.

H5: The intervention would lead students in the experimental group to show more improvement in the measures of motivation than the control group.

H6: The intervention would lead highly motivated students to show greater improvements in metacognition than students with low motivation.

Method

Participants.

The participants (N = 129) in this study were eighth grade students from a magnet school in Hartford, Connecticut. Prior to the commencement of the study, the school's administration and teaching staff agreed to participate in the project and were informed of its focus and overall logistics. In addition, the protocol for this project was approved by the Trinity College Institutional Review Board. Parents of student participants were provided with a letter detailing

the components of the study, and they provided written consent for their child to participate (see Appendix A). Sixty-nine student participants (53.5 percent) identified as female, and 9.3 percent did not report their sex. All the participants in the study were in eighth grade but they ranged in age from 12.75 to 15.33 years, for a sample average of 13.46 years (*SD* = 5.36).

Because magnet schools are public institutions that encourage the enrollment of students from multiple school districts, the sample of participants in this study was diverse in regards to their residential and racial/ethnic background. Most students identified as Hispanic (36.5 percent), White (29.6 percent), or Black (19.1 percent). The remaining students identified as multi-racial (13 percent) or Asian (1.7 percent). The most common hometown listed by participants was Hartford (39.6 percent), and the rest came from 18 surrounding towns in Connecticut.

The participants were from six sections of 8th grade social studies classes, four sections taught by one teacher (Teacher A) and the remaining sections taught by a second teacher (Teacher B). The classroom size ranged from 18 to 22, for a study-wide average of 20 students per section. Both teachers were females of the same race and had similar levels of pedagogical experience. Teacher A had been involved in previous years of the project, while this was the first time that Teacher B collaborated in a study conducted by the research group.

Measures.

The following measures were administered to all students at the end of the first quarter marking period (pre-testing) and upon completion of the intervention at the end of the third quarter marking period (post-testing), while both teachers completed certain ratings of students solely at post-testing. The pre-testing and post-testing stages took place over three different sessions each; all the quantitative measures were evenly split and administered during the first

two days, and the qualitative measure was completed on the third day. All participants were given enough time to complete the entire questionnaire during each testing session. The social studies teacher and/or research-instructor were present throughout the testing sessions to supervise and clarify any questions regarding the measures.

Demographics. The demographic measures consisted of four items, specifically: date of birth, sex, ethnicity/race, and hometown (see Appendix B). These measures were collected only at pre-testing.

Metacognition 5 (MC5). The MC5 was developed by Naratil, Howe, Reuman, and Anselmi (2013) and modified by Godfrey, Lopez, Shimmel, Reuman, and Anselmi (2013) to measure adolescents' metacognitive abilities. The measure is based on Ambrose et al.'s (2010) five-step model of metacognition. The measure was developed with age appropriate wording referring to specific academic tasks relevant to middle school. The instructions asked the student to answer with their social studies class in mind. The measure consisted of 35 self-report items on a five-point frequency scale ranging from "Never" to "Always" (see Appendix C). There were seven items pertaining to each one of the five steps in the metacognitive cycle. The scores were found by determining the average for each of the participant's responses on the thirty-five questions. The MC5 had a Cronbach's alpha of .91 at both pre- and post-testing.

Junior Metacognitive Awareness Inventory (Jr. MAI). The Jr. MAI was designed by Sperling et al. (2002) to measure metacognitive knowledge and ability in students from sixth to ninth grade. The measure consists of 18 self-report items that participants were asked to respond to on a five-point Likert scale ranging from "Never" to "Always" (see Appendix D). The scores were determined by finding the average of the eighteen responses. The Jr.MAI had a Cronbach's alpha of .85 at pre-testing and .88 at post-testing.

Teacher Rating of Metacognition. The Teacher Rating Metacognition is a modified version of the "Teacher Rating of Student Metacognition" measure developed by Sperling et al. (2002). Our measure identified five characteristics of metacognition that correspond to each of Ambrose et al.'s (2010) five steps in the cycle of self-regulated learning (see Appendix E). Teachers rated each student's level of metacognitive on a six-point Likert scale; where 1 = "low metacognition" and 6 = "high metacognition". This measure was completed once by both teachers at post-testing.

Motivated Strategies for Learning Questionnaire (MSLQ). Pintrich, Smith, Garcia, and McKeachie (1992) developed the MSLQ to measure an individual's learning strategies and motivation. For this study, only one of the fifteen scales was used in order to assess participants' beliefs of their self-efficacy. The Self-Efficacy scale is comprised of nine items on a seven-point Likert scale ranging from "Not at all true of me" to "Very true of me" (see Appendix F). The total score was determined by the average of students' responses to the nine questions. The Self-Efficacy scale of the MSLQ had a Cronbach's alpha of .90 at pre-testing and .92 at post-testing.

Ability Beliefs Scale/Implicit Theories of Intelligence Scale. The Implicit Theories of Intelligence Scale was developed by Dweck (1999) as a way to measure children's "growth mindset", which refers to their beliefs about intelligence's malleability. The questionnaire consists of six self-report items on a six-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree" (see Appendix G). A participant's total score consists of the average of the responses to all the items; higher scores reflect a more incremental view of intelligence, while lower scores suggest a more "fixed mindset". The Ability Beliefs Scale had a Cronbach's alpha of .83 at pre-testing, and .89 at post-testing.

Teacher Rating of Ability Beliefs. The Implicit Theories of Intelligence Scale Teacher Report was developed by Dweck (1999) as a tool for teachers to report on students' beliefs about the modifiability of intelligence. The measure asked teachers to rate each student in their classes based on their judgment of his/her type of mindset, assigning each participant a number on a six-point Likert scale; where 1 = "fixed mindset" and 6 = "growth mindset" (see Appendix H). The Ability Beliefs Scale Teacher Report was completed once by both teachers at post-testing.

Performance Measures. The students' quarterly marking period grades for their social studies class were collected from both teachers for the first three marking periods.

Procedure.

The intervention was conducted during the 2013-2014 academic school year, over the course of six in-class sessions ranging from thirty to forty-five minutes. Three of the six sections of social studies classes were assigned to the experimental condition (*Learn 2 Learn*), and the other half were assigned to the control condition (*College Knowledge*). Two college student researchers and a college student research assistant (referred to as research-instructors 1, 2, and 3, respectively) conducted all classroom sessions for both experimental and control conditions (see Table 1).

Pre-testing measures were administered on three separate occasions to all participants in mid-October, towards the beginning of their second quarter marking period. The first two days of testing consisted solely of demographic questions and quantitative paper-and-pencil questionnaires. Prior to administering the qualitative paper-and-pencil measure during the third day of testing, the research-instructors introduced themselves and conducted icebreaker activities with the students. Following the completion of the intervention over a period of seventeen weeks, post-testing was administered to all participants in mid-March. The post-testing stage was

conducted in the same manner as the pre-testing and was comprised of all the same measures, with the exception of the demographic questions. After the post-testing stage was finalized, all participants of the study were taken on a college campus tour at Trinity College.

Pre- and post-testing information and consent forms were kept confidentially in a locked research laboratory. Additionally, participants were assigned an identification number in order to protect their identities while processing the data. Throughout the process of data management, all information was de-identified and entered into an electronic file, which was only accessible to the researchers.

Treatment Protocol.

The intervention period had a duration of seventeen weeks (excluding pre- and post-testing time), which encompassed a total of six in-class sessions for both experimental and control groups. During the first session of both treatments, the research-instructors explained to the students that they were participating in a project conducted by senior college students and faculty at Trinity College. Both social studies teachers reminded the students that their parents had signed permission slips (i.e. consent forms) allowing them to participate in the study.

The sections in the experimental condition (*Learn 2 Learn*) were told by the research-instructor that he/she would be coming in on a regular basis to teach them about ways to improve their learning. The research-instructors teaching the sections of the control condition (*College Knowledge*) explained that the purpose of their weekly sessions would be to provide the students with general insight about college. Teachers A and B, and on a few occasions substitute teachers, were present throughout all treatment sessions in order to help maintain discipline in the classroom.

Experimental Treatment Sessions

The experimental treatment consisted of individual and group activities, classroom discussions, and short homework assignments focused on increasing the students' metacognitive knowledge and abilities. From the beginning of the intervention the research-instructors explained that the *Learn 2 Learn* activities and assignments would not be graded. A point system was implemented as an incentive for students to complete all activities and worksheets; and if participants obtained ninety percent of the total points they received a T-shirt after completion of the post-testing. Furthermore, all students in the experimental treatment received a binder in order to keep track of the handouts and activities that were completed throughout the intervention.

Session 1. Because the research-instructors had already introduced themselves and explained the purpose of the *Learn 2 Learn* sessions during the pre-testing stage, there was no icebreaker or introductory activity during the first session. All students were provided with the *Learn 2 Learn* binder and were given a couple minutes to personalize it. They were also given a laminated sheet with a version of Ambrose et al.'s (2010) five step model, which had been graphically modified and wording-revised to be suitable and appealing to adolescents (see Appendix I). The research-instructor gave basic explanations of each step, provided examples relevant to each component, and prompted students to think about each step throughout the rest of the session.

Next, students were seated in groups of three or four and given a set of instructions for a "Tower Building Activity" (see Appendix J). All groups were given eight minutes to build the tallest tower they could out of toothpicks and marshmallows (provided to them), keeping in mind how they could apply the *Learn 2 Learn* steps to the activity. After they finished, all groups

filled out a blank model handout (see Appendix K), listing the specific tasks of the activity that could correspond to the different steps on the laminated sheet. Then, the research-instructors asked each group to share what they had written for one of the steps, concluding the discussion with a brief explanation of how applying the steps could have led them to the best strategy (e.g. using the toothpicks to build triangular bases, as opposed to quadrangular). Lastly, the session was concluded with an in-class quiz on the *Learn 2 Learn* steps (see Appendix L). The students were asked to complete a homework assignment for the following session, which asked them to explain how they could apply the *Learn 2 Learn* steps if they had to build a tower strong enough to hold their empty binder for five seconds, without falling apart, using the same materials (see Appendix M).

Session 2. For the second session, the research-instructor divided the classroom into groups of three or four and explained that each group was going to build a tower with the specifications mentioned in the homework. The students were asked to discuss their homework assignments with their group and to come up with the best strategy to successfully complete the task. The same materials were provided and the students were encouraged to cover up their structures in the construction process in order to prevent other groups from mimicking their strategy. After eight minutes, all groups were asked to uncover their towers and the research-instructor tested if they could hold the binder without falling apart. Upon completion of the activity, the research-instructor guided a classroom discussion linking the activity to the *Learn 2 Learn* steps, prompting the students to think about (1) what the best approach for the task would be, and why, (2) what had gone wrong throughout the activity, and lastly (3) how they could apply that information to their schoolwork. In order to foster the students' understanding of the *Learn 2 Learn* steps and of their relevancy to the academic setting, they were asked to complete

a homework assignment explaining how they would apply the steps to a particular assignment due before the following session (see Appendix N).

Session 3. For the third session, the research-instructor handed back the in-class quiz on the *Learn 2 Learn* steps and discussed the common mistakes made (e.g., misunderstanding the difference between the steps "monitor performance and apply strategies" and "reflect and adjust" because they did not understand that the former is done throughout the task and the latter is done after the task or assignment has been completed). Second, the students were asked to take out their homework assignment that was provided to them in the previous session. The research-instructor wrote the five steps of the *Learn 2 Learn* model on the board and asked for a student volunteer to come up to the board for each step and write his/her application of the step to their homework assignment for their social studies class. The research-instructor then went over what the students wrote on the board and asked for feedback from the rest of the class to see if they had written anything different or had any feedback for their classmates. Finally, after discussion and reflecting on the homework assignment, the research-instructor explained the fact that there would be a five-week break from the sessions due to Trinity College's winter break.

Winter Booklet (see Appendix O). At the end of session three, the students were given a "Winter Booklet" to complete over the break, which had four activities to be completed over the course of four weeks in order to keep the information that had been covered in the first three sessions fresh in their minds. The goal of the first activity was to remind the students that thinking about your own thinking can improve the outcome of a task. The goal of the second activity was to ask the students to reflect on a vignette about a college student who exhibited low levels of metacognition when assigned a paper for class, and the third activity required the same reflection, except the vignette provided an example of a college student who exhibited high

levels of metacognition. The purpose of the final activity was to have the students reflect on the strengths and weaknesses both college students exhibited in the previously mentioned vignettes. The students were asked questions regarding what they would do similarly and what they would do differently if given the same assignment.

Session 4. For the fourth session, the research-instructor reviewed the activities done in the Winter Booklet through an interactive discussion prompted by a PowerPoint presentation. The first component of the discussion asked students to share with the class what they believed both college students in the vignettes did well, and what they needed to improve on in order to do well on their paper assignment. The second component asked the students to discuss how the college student who exhibited high metacognition applied the *Learn 2 Learn* steps when writing his paper (e.g., read directions carefully, balanced heavy workload, outlined his paper, made an outline, and proofread his work).

Finally, the research-instructor provided examples of what made learning hard for him/her in school, in addition to more general difficulties individuals experience when learning. The session was concluded with an activity (see Appendix P) that asked students to write one example of what made learning hardest for them, which would be collected by the research-instructor.

Session 5. Based on responses to the activity done in the previous session, the fifth session was catered to the specific learning difficulties experienced by the students in the current study. The research-instructor provided a PowerPoint presentation of learning tips for the students to help them with busy schedules, distractions, lack of interest in or difficulties understanding their subject matter, and personal life conflicts. The session was concluded with an activity (see Appendix Q), which first asked students to sign a paper that promised they would

make a commitment to not distract their fellow classmates when they are in school. Second, the students were asked to write one short-term goal from the learning tips that they believed would help them the most and one long-term goal that they believed would keep them motivated even when their work was boring. Finally, the research-instructor asked for volunteers to share their goals with the class.

Session 6. For the final session, the research-instructor introduced the notions of fluid and fixed intelligence through a PowerPoint presentation that was made suitable for an eighth grade audience. The idea that one's intelligence is fluid, malleable and something that can be improved was emphasized throughout the entire session. The research-instructor explained that the brain is similar to a muscle, with brain cells that can grow and multiply with practice and repetition of a certain task or skillset. In regards to the *Learn 2 Learn* model, it was explained to students that believing intelligence is fluid and can be improved is related to their motivation to learn, especially when experiencing feelings of incompetence in certain subjects.

The session concluded with an activity asking the students to imagine they were entering ninth grade and to think about the advice they would have given to themselves when they were entering eighth grade. The research-instructor shared with the students the advice he/she would have given to him/herself in eighth grade as an example for them to feed off of. The students were then asked to share their advice with the rest of the class.

Control Treatment Sessions

The control group received six sessions on information regarding college and the process of applying and transitioning to college. The first session discussed earnings and unemployment rates based on educational attainment in order to solidify the importance of a bachelor's degree in today's society. The session was concluded with a conversation regarding the social aspects of

college, including what living with roommates entails, the cultural experiences you can have, and the diversity of various campuses.

The second session covered the differences between public, private, and community colleges and universities. Participants were informed of the differences in student enrollment numbers and shown various campus maps to observe the range of campus sizes they could choose from. Finally, the research-instructor addressed the process of selecting a location for your college or university in relation to your family or the part of the country you would like to be in.

In the third session, the research-instructor addressed the cost breakdown of a typical college and the different ways to afford tuition, such as financial aid and academic and athletic scholarships. Additionally, the experience of a college visit was described and the research-instructor mentioned his/her college visits and what the process entails.

The fourth session was a spin off of the game "MASH" and was catered to subject matter pertaining to college and university life. The fifth session first focused on extracurricular activities that are available at most colleges and then focused on the application process. The students were provided with advice in regards to the interview process, the college essay, and the activities they should participate in to build their transcript. The final session included a tour of a college campus with the research-instructor.

Results

Correlations among All Measures

Table 2 contains all the correlations among the self-reported measures, the teacher reports, and the quarterly grades. All measures used in the study showed strong stability from pre- to post-testing; these correlations for the five measures ranged from $r = .59$ to $r = .78$.

All measures of metacognition were positively correlated with each other. The MC5 and Jr. MAI showed strong positive correlations of $r = .76$ at pre-testing, and $r = .72$ at post-testing. The MC5 and the Teacher Rating of Metacognition showed more moderate correlations with $r = .30$ at pre-testing, and $r = .36$ at post-testing. The Jr. MAI and the Teacher Rating of Metacognition showed weaker positive correlations than the other measures of metacognition; at pre-testing $r = .19$, and at post-testing $r = .16$.

Furthermore, the quantitative self-report measure of metacognition developed for the present program of research (MC5) was found to be a better predictor of grades than the widely used previously published measure (Jr. MAI). At pre-testing, the MC5 showed correlations of .39, .35, and .30 with quarterly grades (1^{st} – 3^{rd} respectively), while with the Jr. MAI $r = .24$, .20, and .12. At post-testing, quarterly grades showed the same pattern with correlations of .42, .44, and .34 with the MC5, and $r = .27$, .25, and .12 with the Jr. MAI.

Moreover, the Teacher Ratings of Metacognition and Ability Beliefs were found to be the strongest predictors of academic performance out of all the measures used in the study. For the Teacher Rating of Metacognition, $r = .58$ at the 1^{st} quarter, $r = .74$ at the 2^{nd} quarter, and $r = .78$ by the 3^{rd} quarter. Similarly, for the Teacher Rating of Ability Beliefs, $r = .64$ at the 1^{st} quarter, $r = .75$ at the 2^{nd} quarter, and $r = .80$ by the 3^{rd} quarter.

Lastly, all self-reported measures of metacognition were positively correlated with the self-reported measures of motivation, especially with the Self-Efficacy scale. At pre- and post-testing, Self-Efficacy was strongly correlated with MC5 ($r = .64$ & $r = .71$) and Jr. MAI scores ($r = .61$ & $r = .68$). Likewise, Ability Beliefs showed moderate correlations with the MC5 ($r = .37$ & $r = .38$) and Jr. MAI ($r = .27$ & $r = .27$) at both testing times.

Metacognition 5 (MC5)

Table 3 contains the control and intervention groups' descriptive statistics for the MC5 scores at pre- and post-testing. A repeated-measures ANOVA was conducted for this measure with condition as the between-subjects factor and time as the within-subjects factor. There was no main effect of condition, thus the average MC5 scores between the control and experimental groups did not differ at pre- or post-testing, F (1, 104) = .43, p = .51, partial η^2 = .004. Likewise, no significant effect of time was found, F (1, 104) = .44, p = .51, partial η^2 = .004. However, a significant condition by time interaction effect was found for average MC5 scores, F (1, 104) = 5.35, p = .023, partial η^2 = .049. Hence, the repeated-measures ANOVA showed that after the intervention, the experimental group showed more improvement in their MC5 scores than the control group (see Figure 1).

A second repeated-measures MANOVA was conducted in order to test effects of time and condition on the separate steps of the MC5. The MANOVA reflected no condition by step interaction effect, F (4, 416) = .72, p = .58, partial η^2 = .007; the MC5 step-specific mean scores did not differ between the control and experimental groups. Likewise, no significant interaction effect of time by MC5 step was found, F (4, 416) = .62, p = .65, partial η^2 = .006. Furthermore, there was no interaction effect for condition, step, and time, F (4, 416) = .40, p = .81, partial η^2 = .004. This repeated-measures MANOVA showed that the intervention does not generate improvement through a particular step, as reflected by the lack of the aforementioned interaction effects. However, a significant main effect of MC5 step was found, F (4, 416) = 42.98, $p < .001$, partial η^2 = .292. The overall sample showed significantly larger means for "Assess the Task" (M = 3.82, SE = .05) and "Reflect and Adjust" (M = 3.81, SE = .06), followed by "Evaluate Strengths and Weakness" (M = 3.53, SE = .05) and "Apply Strategies and Monitor Performance"

(M = 3.50, SE = .06), while "Planning" had the lowest average score (M = 3.34, SE = .06) (see Figure 2).

Junior Metacognitive Awareness Inventory (Jr. MAI)

Table 4 contains the control and intervention groups' descriptive statistics for the Jr. MAI scores at pre- and post-testing. A repeated-measures ANOVA was also conducted for the analysis of effects of time and condition on this measure. No main effect of condition was found, the average Jr. MAI scores did not differ at pre- or post-testing between the control and experimental groups, F (1, 106) = .25, p = .62, partial η^2 = .002. Likewise, no significant effect of time was found, F (1, 106) = 1.29, p = .26, partial η^2 = .012. Similarly, there was no significant interaction effect of condition by time, F (1, 106) = 2.71, p = .10, partial η^2 = .025. Thus, the repeated-measures ANOVA showed that the intervention did not lead to the experimental group to attain higher scores on the Jr. MAI than the control group (see Figure 3).

Self-Efficacy

Table 5 contains the control and intervention groups' descriptive statistics for the MSLQ Self-Efficacy scores at pre- and post-testing. A repeated-measures ANOVA was also conducted for the analysis of effects of time and condition on this measure. A main effect of condition was found for the Self-Efficacy scale; the average score of the experimental group was significantly higher than the control's at both pre- and post-testing, F (1, 105) = 5.46, p = .02, partial η^2 = .049. However, no significant effect of time was found, F (1, 105) = 1.25, p = .27, partial η^2 = .012. Similarly, there was no interaction effect of condition by time, F (1, 105) = .10, p = .75, partial η^2 = .001. In spite of a main effect of condition, the intervention did not lead the experimental group to show more improvement than the control group in their Self-Efficacy scores at post-testing (see Figure 4).

Ability Beliefs

Table 6 contains the control and intervention groups' descriptive statistics for the Ability Beliefs scale at pre- and post-testing. A repeated-measures ANOVA was also conducted for the analysis of effects of time and condition on this measure. No main effect of condition was found for this scale, mean scores did not differ at pre- or post-testing between the control and experimental groups, F (1, 102) = 2.42, p = .12, partial η^2 = .023. However, a significant effect of time was found, F (1, 102) = 11.64, $p \leq .001$, partial η^2 = .102; both experimental and control groups showed higher average scores at post- than pre-testing. The repeated-measures ANOVA indicated that there was no interaction effect of condition by time, F (1, 102) = 1.15, p = .29, partial η^2 = .011. In spite of an overall improvement of mean scores from pre-test to post-test, the intervention did not lead to the experimental group to score higher than the control group on the Ability Belief scale at post-testing (see Figure 5).

High/Low Motivation Groups

A median split was used to divide the sample into high and low motivation groups (for both N = 52), based on their scores on the Self-Efficacy and Ability Beliefs scales. A repeated-measures ANOVA was used in order to analyze potential interaction effects of time, condition, and motivation on MC5 scores. The analysis using Self-Efficacy as the motivation variable showed no 3-way interaction effect of self-efficacy by time and condition, F (1, 100) = 1.33, p = .25, partial η^2 = .013 (see Figure 6). Likewise, the motivation group's based on median split of Ability Beliefs scores showed no 3-way interaction effect of ability beliefs by time and condition, F (1, 100) = 0.03, p = .86, partial η^2 = .000 (see Figure 7). These ANOVAs showed that the intervention did not have dissimilar effects based on the participant's level of motivation,

as reflected by the lack of MC5 mean differences between the motivation groups within the experimental and control groups.

Teacher Reports

Table 7 contains the control and intervention groups' descriptive statistics for the Teacher Ratings of Ability Beliefs and Metacognition. Because the teachers only completed these two measures once, I used a *t*-test for independent samples to determine whether the mean group ratings differed between the experimental and control groups. There was no significant difference between the condition groups in terms of the teacher's mean rating of the students' metacognition, t (114) = 1.49, p = .14. Likewise, there was no significant difference between the condition groups in terms of the teacher's mean rating of the students' Ability Beliefs, t (114) = 1.48, p = .14. The *t*-tests of both measures showed that upon completion of the intervention, the teachers did not rate the experimental group more highly than the control group in regards to their growth mindset and metacognitive abilities (see Figure 8).

Academic Performance

Table 8 contains the control and intervention groups' descriptive statistics for the measure of academic performance. A repeated-measures ANOVA was also conducted for the analysis of effects of time and condition on quarterly grades. No main effect of condition was found for academic performance, mean grades did not differ between the control and experimental groups at pre- or post-testing, F (1, 108) = .21, p = .65, partial η^2 = .002. However, a significant effect of time was found, F (2, 216) = 24.51, p < .001, partial η^2 = .185; both experimental and control groups' average grade showed a decline with time. The repeated-measures ANOVA indicated that there was no interaction effect of condition by time for quarterly grades, F (2, 216) = 1.58, p = .21, partial η^2 = .014. Contrary to my predictions, the

experimental group did not show statistically higher academic performance than the control group at the 3rd quarter marking period. The experimental group showed less of decline in grades at the 3rd quarter than the control group, although not at a statistically significant level (see Figure 9).

Discussion

This study aimed to improve learning and academic performance in eighth grade classrooms by implementing a metacognitive intervention into the social studies curriculum. As expected, the students in the experimental group showed more improvement in metacognition than the control group, as reflected by their MC5 scores. In accordance with Dignath and Büttner's (2008) findings, interventions using explicit instruction of metacognition can lead to an increase in metacognitive knowledge and ability. Through group work and cognitive discussions, the current intervention succeeded in raising students' metacognitive awareness (Paris & Paris, 2001).

Howe (2013) developed an intervention for the same age group and with the same objectives as the current study but found no improvement of student's metacognitive awareness as measured by a previous version of the MC5. This study sought to develop a new metacognitive intervention based on Howe's (2013) findings. The current intervention moved away from teaching the steps of Ambrose's model (2010) separately and switched to placing more emphasis on metacognition as a cyclical process comprised of interdependent steps. The research-instructors always referred to the cycle as a whole and explained that effective learning takes places upon mastery of the loop of steps across different tasks. Learning strategies were never introduced in isolation or in relation to a single step; skills were always explained relative to their positive effect on the entire cycle of steps.

Furthermore, in order to ensure that the students understood the importance and utility of metacognition beyond the academic setting, the *Learn 2 Learn* steps were explained to the students in relation to both academic and non-academic tasks. Once the participants showed an overall understanding of the cycle in non-academic tasks, the research-instructors introduced the model in relation to their social studies curriculum and academic tasks in general. Thus, the intervention allowed students to gain metacognitive awareness at a general level and then more specifically upon basic comprehension of the theory.

Moreover, greater emphasis was placed on group work and reflective discussions aiming at promoting students' constant cognitive engagement during the sessions. The research-instructors avoided lecturing at the participants and instead promoted an environment of active involvement by the students. Additionally, the research-instructors promoted positive ideas about learning and attempted to create a supportive environment where all contributions by the participants were welcome and highlighted as valuable to the classroom. The sessions also fostered notions of self-efficacy and growth mindset among the students.

Based on Howe's (2013) findings, the current design developed the "Winter Booklet" as a way to foster participants' recollection of the intervention material during their school break. This booklet allowed the students to work on gaining metacognitive awareness autonomously and in absence of direct instruction by the research-instructors. Likewise, the point system implemented gave the students a chance to earn an incentive (i.e. a T-shirt) contingent on their self-regulatory abilities and motivation; the students were given points upon completion of the homework at their own time and discretion, without any impact to their grades.

Emphasis on the aforesaid aspects allowed the current study to develop an effective metacognitive intervention, which consequently led to an increase of the participants'

metacognition, as measured by the MC5. The revisions made to the MC5 allowed the measure to align more closely to Ambrose et al.'s (2010) theoretical model, and thus to more accurately measure the effects of the intervention. While previous research projects had found that the first version of the MC5 was positively correlated with pre-existing measures of metacognition like the Jr. MAI, they had failed to show a link between measures of academic performance (i.e., grades) and the MC5 (Howe, 2013; Naratil, 2013). The current version of this instrument maintained the positive link to the Jr. MAI, and more importantly, exhibited a strong positive link to criteria of academic performance, which will be discussed later on. Overall, the development of a new intervention and the revisions to the MC5 in accordance to Ambrose et al.'s (2010) theoretical framework of metacognition represented key components to the promising findings of the current research project.

However, the current intervention did not lead students in the experimental group to show greater academic improvement than the control group. This finding does not support extant research suggesting that metacognitive interventions can lead to improvement in academic achievement (Kistner et al., 2010). However, despite finding a drop in grades from the 1st through the 3rd quarter marking period, the experimental group showed less of a decline than the control group (although not at a significant level). The downward trajectory in grades for both experimental and control groups has been reported in the previous studies (Howe, 2013; Blackwell et al., 2007). Blackwell et al.'s (2007) findings suggest that interventions with a greater focus on promoting an incremental intelligence theory might be more promising in halting the grade decline for the experimental group.

Nevertheless, it remains possible that increased metacognitive awareness generates academic improvements in the long-term, which would account for the lack of short-term gains

in the current study. Analyzing fourth quarter grades could provide greater insight and potentially reflect gains in academic performance by the experimental group, as indicated by a greater gap between both group's mean grades. Furthermore, while the intervention did not produce an effect on course grades by the 3rd quarter, metacognition was positively correlated with grades at all quarter marking periods; supporting previous findings linking students' metacognitive awareness and academic achievement (Ambrose et al., 2010; Cross & Paris, 1988).

As predicted, the measure of metacognition (MC5) developed for the present program of research was found to be a better predictor of academic performance than the widely used previously published measure, the Jr. MAI. Because this study's intervention was based on Ambrose et al.'s (2010) model, the MC5 represented a better way to assess changes in students' level of metacognition. Likewise, the five steps of the cycle seemed to better conceptualize the metacognitive processes that are relevant to self-regulated learning, and thus academic performance. In accordance with previous findings, self-regulated learning plays a key role in academic performance; high achieving students show mastery of the self-regulatory feedback loop (Ambrose et al., 2010; Cleary & Zimmerman, 2004).

Similarly, the findings supported the prediction that all measures of motivation would be positively correlated with academic performance. In accordance with the literature, motivation plays a key role in triggering and maintaining effective learning behaviors, which in turn lead to higher academic achievement (Cleary & Zimmerman, 2004; Metallidou & Vlachou, 2010). In fact, the current study found that teacher ratings of students' mindset (i.e., implicit theories of intelligence) were the best predictors of students' grades. In line with Blackwell et al.'s (2007)

findings, incremental theorists tend to endorse behaviors in the academic setting that are conducive to high achievement.

Against my fifth and sixth predictions, the intervention did not (1) lead students in the experimental group to show more improvement in the measures of motivation than the control group, or (2) lead highly motivated students to show greater improvements in metacognition than students with low motivation. While motivation and metacognition are closely related and interdependent in self-regulated learning, explicit instruction of metacognitive knowledge and skills did not result in more positive motivation among the experimental group or benefit highly motivated students to a greater extent. Nonetheless, all self-reported measures of metacognition and motivation were positively correlated. Thus, while gains in metacognition did not lead to the same pattern in self-efficacy and ability beliefs, students exhibiting high metacognition also tended to have more positive motivational characteristics (e.g., high self-efficacy, growth mindset). Research supports the idea that interventions purported to enhance motivation should incorporate instruction of strategies related to this construct in order to increase motivation (Cleary & Zimmerman, 2014). Thus, given that the intervention's primary focus was metacognition, it is not unexpected to see that it did not have greater effects on motivation, or differentially generated metacognitive improvement based on level of motivation.

Limitations

A minor limitation of the current study was the lack of a "warm-up period" prior to starting the pre-testing, which would have allowed the research-instructors to establish better rapport with the students. Research findings suggest that (1) an effective learning environment should consistently provide "positive socio-emotional support", and (2) it is important to identify students' individual needs and tailor the intervention accordingly (Cleary & Zimmerman, 2004;

McCombs & Marzano, 1990). A "warm-up" period would have allowed the research-instructor to gain greater insight about the students' learning styles and difficulties. Furthermore, this period of time could have made the students feel more comfortable around the research-instructor.

Future Research

The current study could have benefited from incorporating long-term measures of academic performance. Future research of self-regulated learning interventions should be longitudinal in order to analyze the stability of metacognitive improvements over time, as well as potential long-term effects in academic achievement. It would be worthwhile to follow up on the current sample of students by the end of the 4th quarter in order to see if the intervention succeeded at halting the experimental group's decline in grades.

Moreover, future research should encompass multiple measures of academic performance beyond average grades. Research supports the notion that certain tasks require more metacognitive ability than others; a long-term project involves more self-regulation than tasks requiring rote memorization (Paris & Paris, 2001). Hence, using assignments that involve higher metacognitive engagement could be better ways to assess changes in academic performance.

Future research could benefit from expanding the sampling scope to classes other than mathematics and science. While this research project has incorporated social studies classrooms into the research of self-regulated learning interventions, the field could greatly benefit from exploring the generalizability of these training programs across other disciplines. Likewise, it would be valuable to replicate the current study with younger (6th – 7th grade) and older (high school) age groups.

The current study's findings seem to support the notion that middle school students and adolescents in general struggle with planning (Ambrose et al., 2010; Harvey, 2002). Given the importance of the metacognitive process of planning for self-regulated learning, interventions targeting this age group should incorporate specific strategies to enhance this ability. Harvey (2002) suggests that learning portfolios are an effective method to promote planning, reflection, self-evaluation, and autonomy. Encouraging more autonomous self-monitoring is very important with this age group, especially prior/during their transition to high school where teachers scaffold planning strategies to a much lesser extent.

Implications

The findings of the present study support extant research showing that metacognitive interventions can lead to increased metacognitive awareness and can be readily taught in the classroom (Dignath, & Büttner, 2008). Researchers have emphasized the importance of self-regulation in the academic setting, based on the notion that mastery of self-regulated learning, and metacognition in particular, leads to better quality of learning and higher academic achievement (Ambrose et al., 2010; McCombs & Marzano, 1990).

It would be beneficial for all students if academic institutions implemented explicit metacognitive instruction into their curricula. However, a meta-analysis of self-regulated learning interventions suggested that training programs were more effective when conducted by a researcher, as opposed to the regular classroom teacher (Dignath & Büttner, 2008). Hence, future research should focus on developing effective interventions suitable for instruction by teachers that have the same effect as those taught by researchers.

Conclusions

Researchers should continue to collaborate with educators on the development of effective interventions for the classroom than can increase students' metacognition, have positive effects on their academic performance, and overall make them better learners. Greater attention should be paid to typical self-regulatory learning failures within an age group (keeping developmental stages in mind), as important sources of insight for the design of interventions. Self-regulated learning interventions should be implemented to support major transitional stages (e.g. middle school to high school, high school to college). During these transitional periods, individuals' self-regulatory difficulties tend to become more apparent and affect their academic performance; failure to adequately adapt to the new stage can negatively affect the student's self-concepts and motivation to learn.

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Tables

Table 1.

Distribution of 8th grade sections across conditions and research-instructors

Section	Teacher A		Teacher B	
	Condition	RI	Condition	RI
A	Experimental	1	-	-
B	Experimental	1	-	-
C	Control	2	-	-
D	-	-	Control	3
E	Control	3	Experimental	2

Note. RI = Research-instructor.

Table 2.

Correlations among all measures at pre- and post-testing

Measures	1	2	3	4	5	6	7	8	9	10	11	12	13
Pre-Testing													
1. MC5													
2. Jr. MAI	.76**												
3. AB	.37**	.27**											
4. SE	.64**	.61**	.32**										
Post-Testing													
5. MC5	.75**	.66**	.29**	.68**									
6. Jr. MAI	.59**	.64**	.22*	.57**	.72**								
7. AB	.34**	.24**	.59**	.46**	.38**	.27**							
8. SE	.63**	.56**	.21*	.75**	.71**	.68**	.31**						
9. T-MAI	.30**	.19*	.24*	.46**	.36**	.16	.34**	.39**					
10. T-AB	.29**	.19*	.23*	.51**	.40**	.19*	.29**	.46**	.92**				
Grades													
11. Q1	.39**	.24*	.14	.52**	.42**	.27*	.23*	.52**	.58**	.64**			
12. Q2	.35**	.20*	.21*	.39**	.44**	.25*	.27*	.51**	.74**	.75**	.74**		
13. Q3	.30**	.12	.15	.42**	.34**	.12	.22*	.43**	.78**	.80**	.66**	.78**	

Note. MC5 = Metacognition 5; Jr. MAI = Junior Metacognitive Awareness Inventory; AB = Ability Beliefs, SE = MSLQ Self-Efficacy Scale; T-MAI = Teacher Rating of Metacognition; T-AB = Teacher Rating of Ability Beliefs; Q = Quarter Marking Period.

** Correlation is significant at the .001 level (2-tailed)

* Correlation is significant at the .05 level (2-tailed).

Table 3

Effects of Time and Condition on MC5

	Experimental (N = 53)		Control (N = 53)	
Time	*M*	*SD*	*M*	*SD*
Pre-Testing	3.58	0.51	3.60	0.52
Post-Testing	3.68	0.45	3.54	0.52

Table 4

Effects of Time and Condition on Jr. MAI

	Experimental (N = 50)		Control (N = 58)	
Time	*M*	*SD*	*M*	*SD*
Pre-Testing	3.70	0.51	3.72	0.48
Post-Testing	3.82	0.53	3.70	0.62

Table 5

Effects of Time and Condition on Self-Efficacy

	Experimental (N = 50)		Control (N = 57)	
Time	*M*	*SD*	*M*	*SD*
Pre-Testing	5.71	0.95	5.30	1.14
Post-Testing	5.65	0.90	5.19	1.12

Table 6

Effects of Time and Condition on Ability Beliefs

	Experimental (N = 52)		Control (N = 52)	
Time	*M*	*SD*	*M*	*SD*
Pre-Testing	4.44	1.04	4.26	0.97
Post-Testing	4.84	1.00	4.47	1.00

Table 7

Effects of Condition on Students' Characteristics

	Experimental (N = 54)		Control (N = 62)	
Teacher Report	*M*	*SD*	*M*	*SD*
Metacognition	4.26	1.56	3.77	1.91
Ability Beliefs	4.31	1.61	3.82	1.92

Table 8

Descriptive Statistics for Course Grades

	Experimental (N = 52)		Control (N = 58)	
Time	*M*	*SD*	*M*	*SD*
First Quarter	83.10	12.56	83.59	12.08
Second Quarter	82.19	11.18	81.36	11.76
Third Quarter	76.76	12.92	76.22	13.45

Figures

Figure 1. MC5 Mean Scores at Pre- and Post-Test

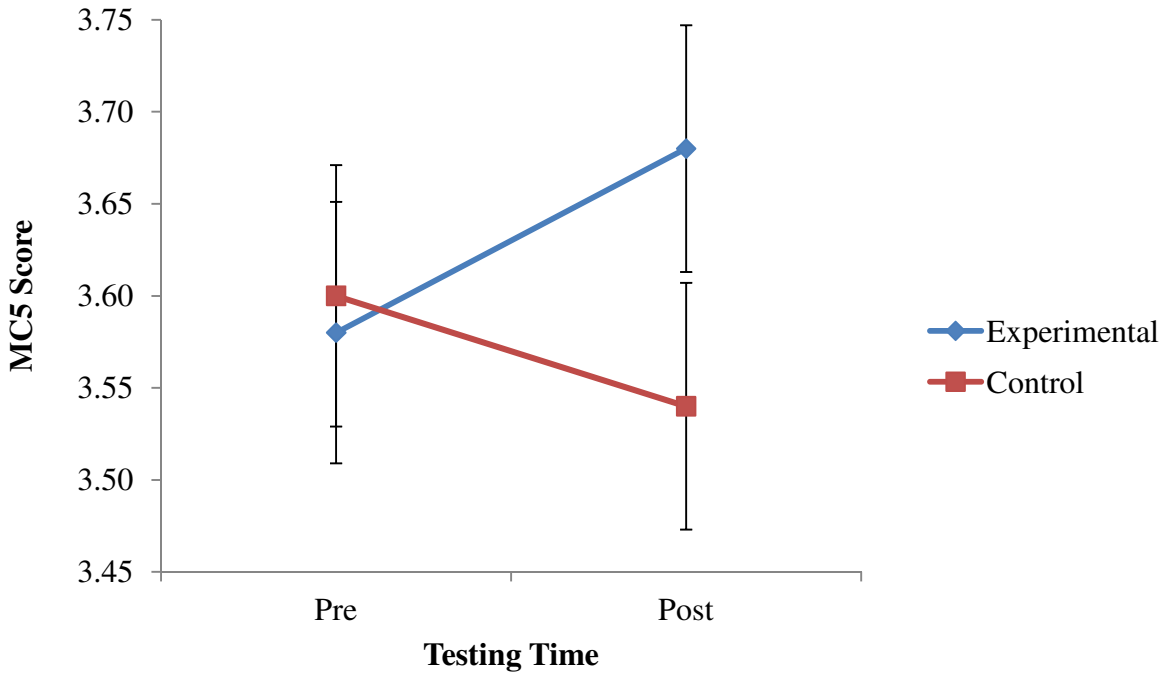


Figure 2. Sample Mean Scores on Separate MC5 Steps

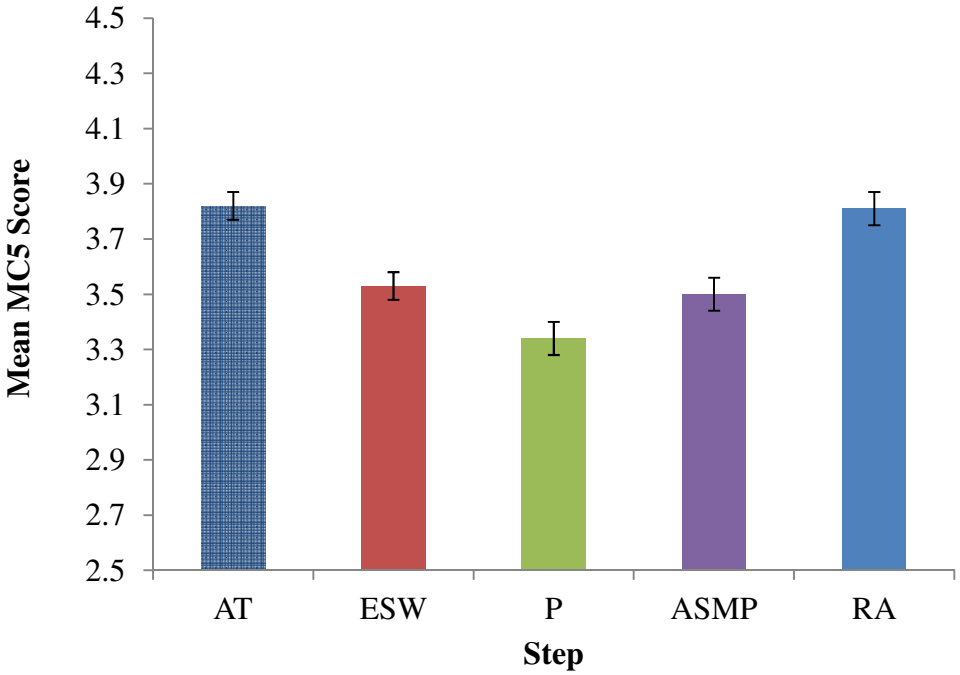


Figure 3. Jr. MAI Mean Scores at Pre- and Post-Test

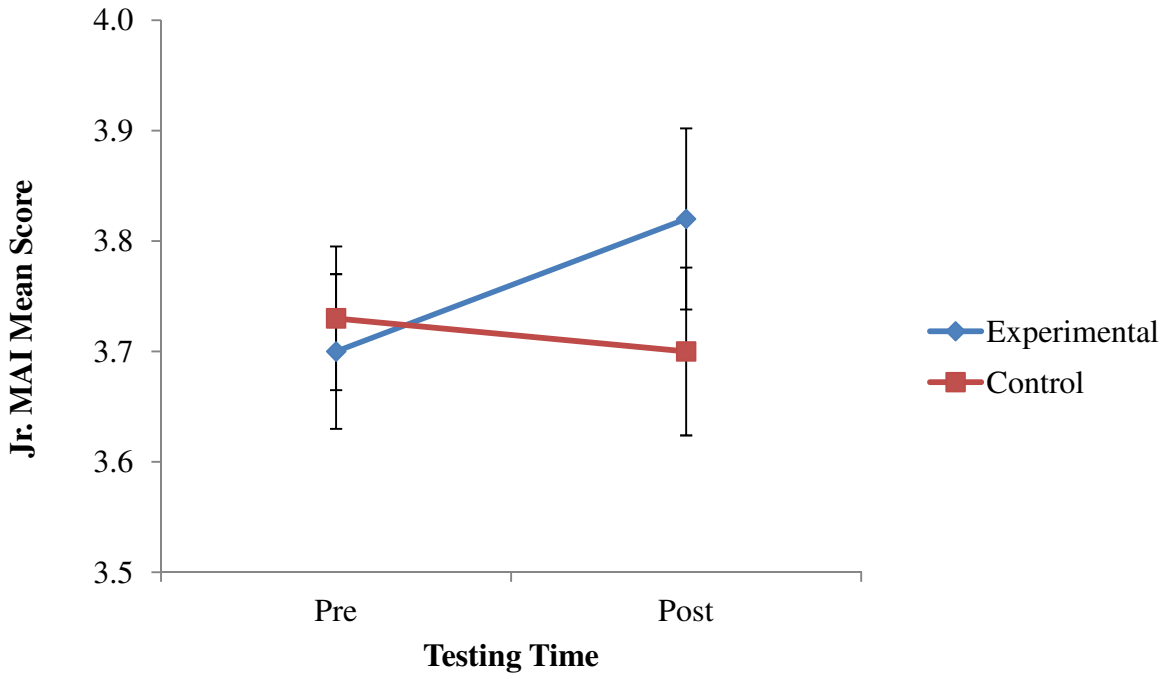


Figure 4. MSLQ Self-Efficacy Mean Scores at Pre- and Post-Test

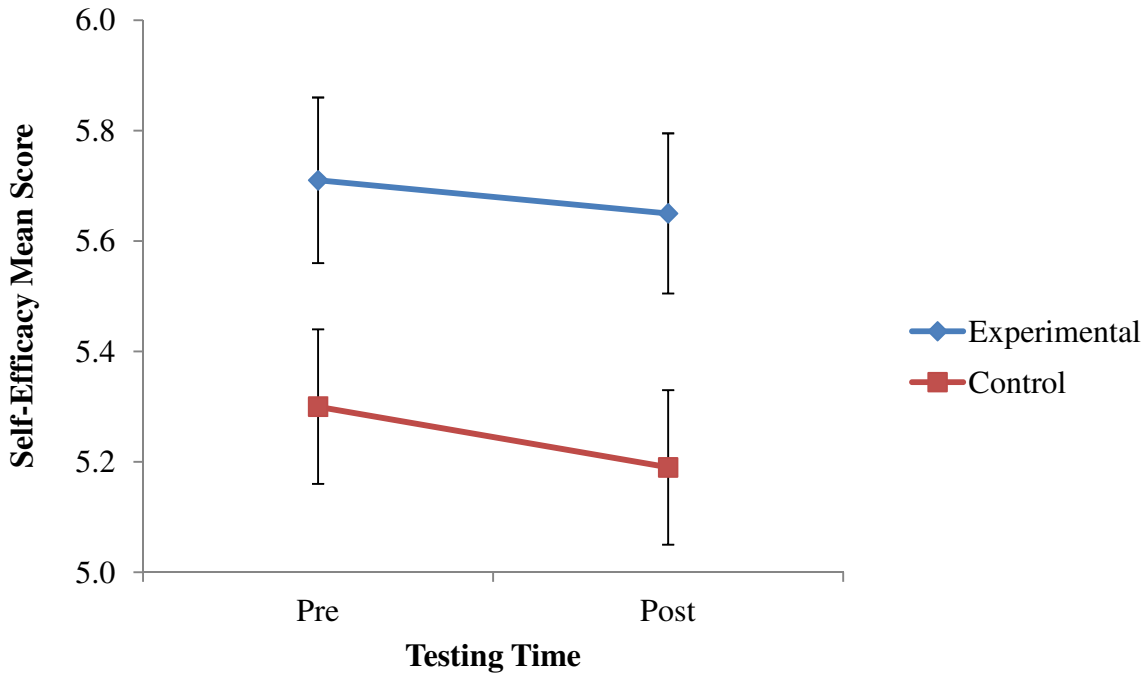


Figure 5. Ability Beliefs Mean Scores at Pre- and Post-Test

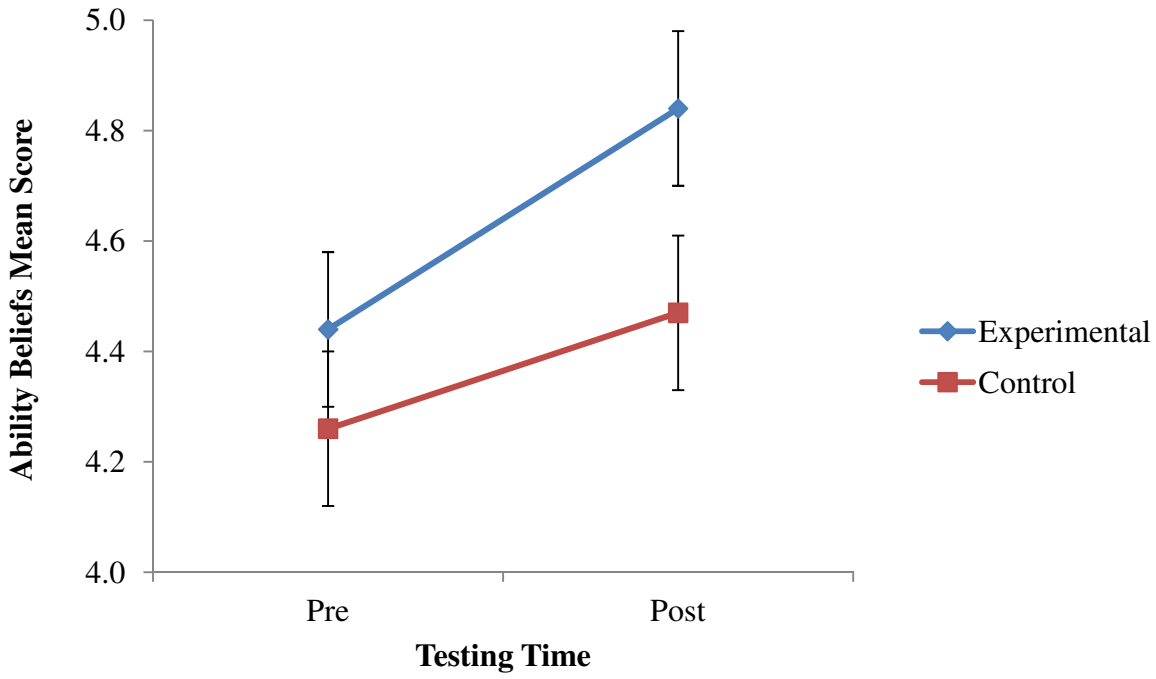


Figure 6. Hi-Lo Self-Efficacy Groups Mean MC5 Scores

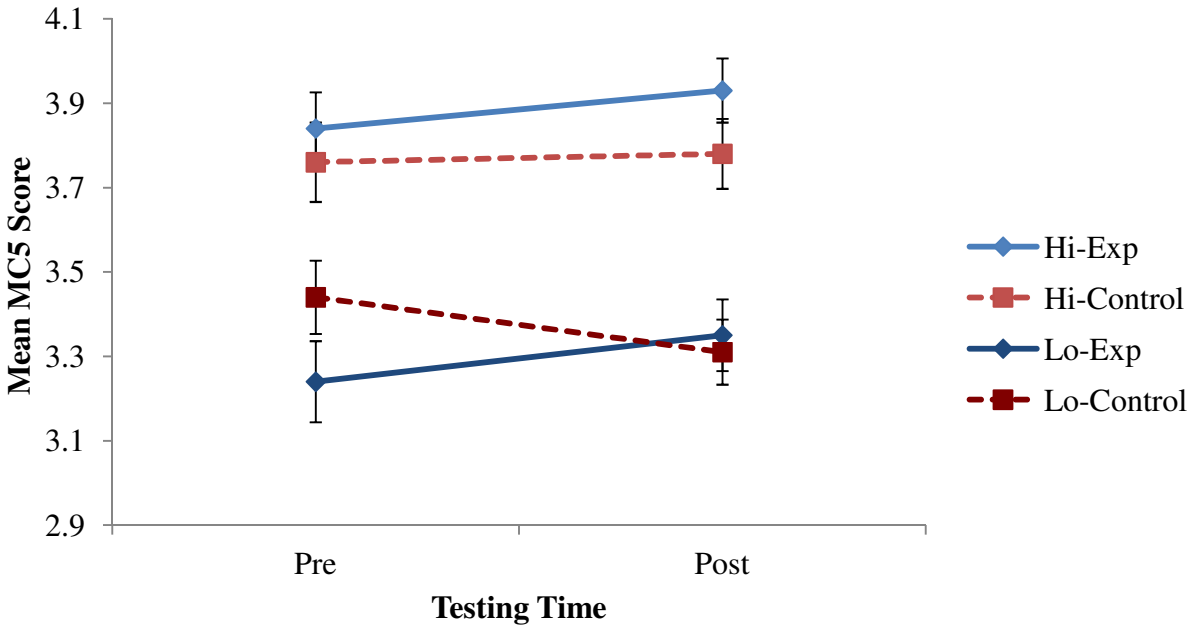


Figure 7. Hi-Lo Ability Beliefs Group Measures on MC5

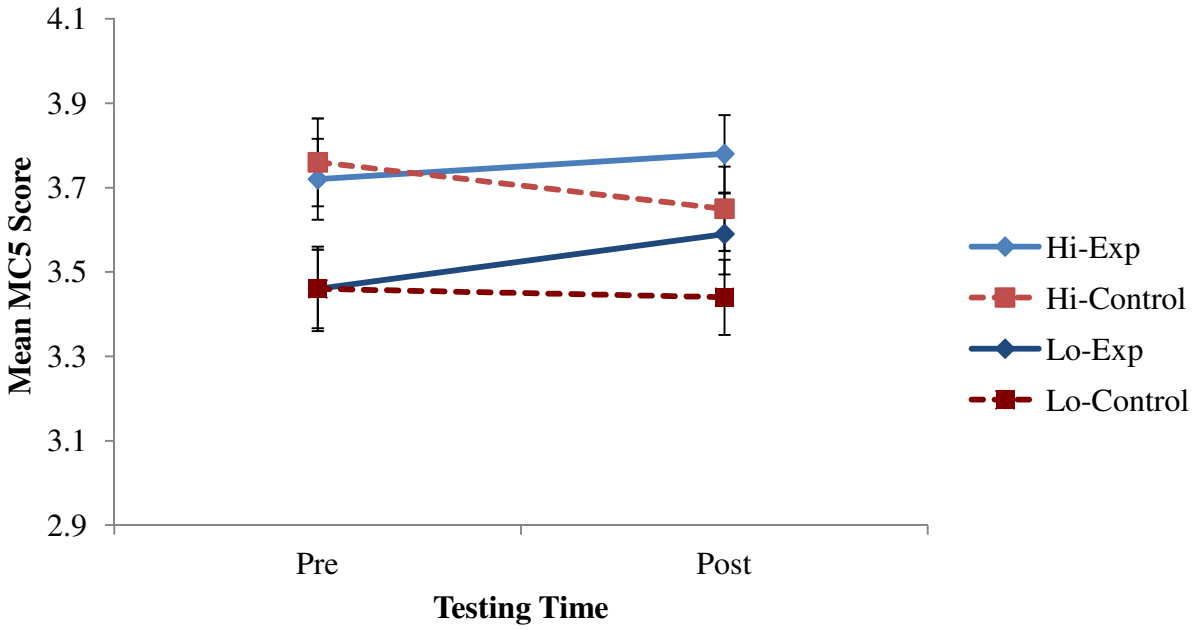


Figure 8. Teacher Ratings of Students Metacognition and Ability Beliefs

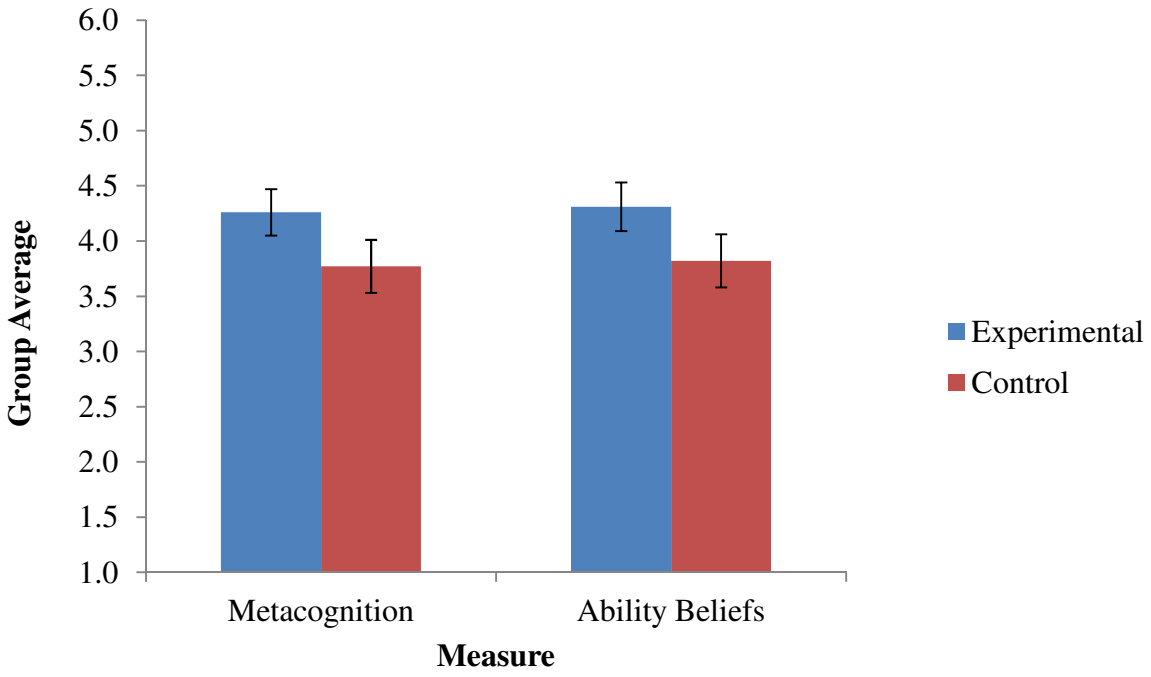
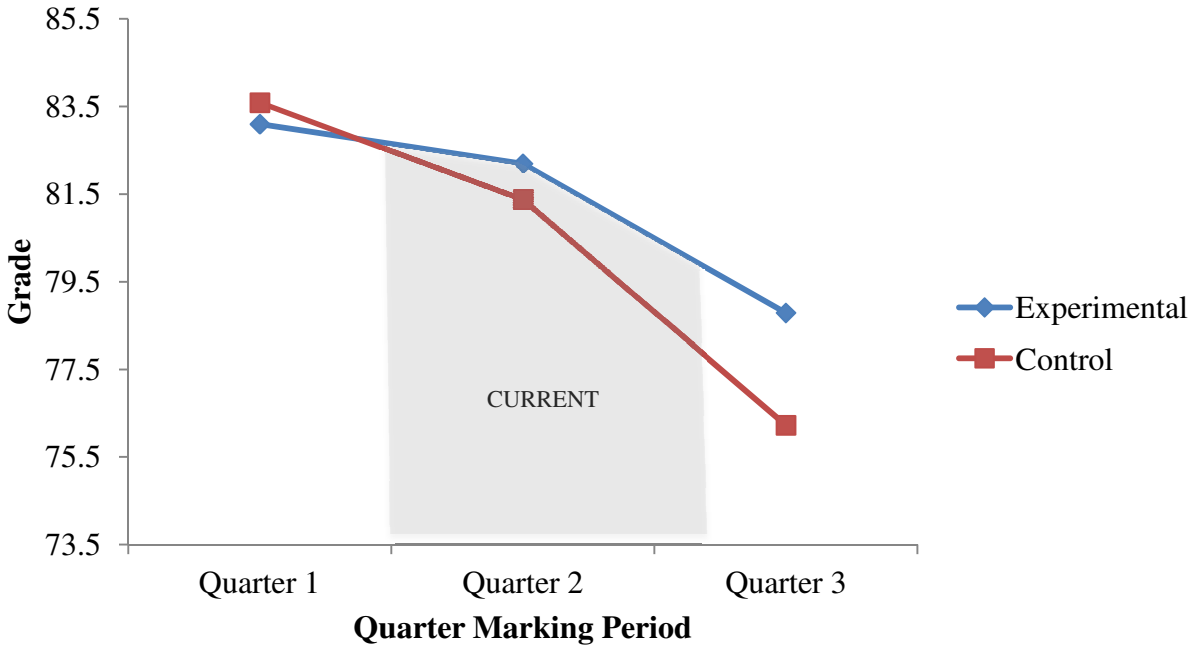


Figure 9. Means of Quarter Grades at Three Times (2013-2014)



Appendix A

HARTFORD Public Schools
CHOOSE. ACHIEVE. SUCCEED.

HARTFORD MAGNET TRINITY COLLEGE ACADEMY
at The Learning Corridor
Sally A. Biggs, Principal
Stacy Chambers, Resident Principal
Sheldon Neal, Assistant Principal
Gwyndolyn Adams, Assistant Principal

Trinity College
Hartford, Connecticut

Dear Parent/Guardian,

As part of the Learning Corridor partnership and our relationship with Trinity College we have been invited to participate in the piloting of a research project. The students in Ms. Avery's class will be learning about strategies that may help improve academic motivation. The study, *Self-Regulated Learning- Metacognition & Achievement in Middle School*, is designed to measure students' motivational beliefs and ways in which students self-regulate their learning.

During the 2nd Marking Period students will answer questions about their learning styles, learn effective study skills, and engage in small group activities to stimulate learning. We anticipate the project will take approximately 4-5 hours (20-30 minute sessions) spread out over the duration of one marking period. Trinity Professors, Dina Anselmi and David Reuman, will be overseeing the project and the classroom activities will be conducted by Trinity students with the direct supervision of Ms. Avery.

If you have any questions or concerns regarding this exciting opportunity, please feel free to contact Ms. Avery (860-695-7226) and/or Mrs. Biggs (860-695-7201). We look forward to sharing our research results in the spring. Please sign this consent form indicating you have read this letter & agree to have your child participate in this study.

Sincerely, Ms. Avery

Title of Project: Self-Regulated Learning: Metacognition & Achievement in Middle School

Principal Investigators: Dina Anselmi, Ph.D. (860) 297-2236 or Dina.Anselmi@trincoll.edu
Department of Psychology, Trinity College, Hartford, CT 06106

David Reuman, Ph.D. (860) 297-2341 or David.Reuman@trincoll.edu
Department of Psychology, Trinity College, Hartford, CT 06106

Deb Avery davery@hartfordschools.org
Hartford Magnet Middle School, Hartford, CT 06106

I acknowledge that I have received and read a letter explaining the study of *Self-Regulated Learning: Metacognition & Achievement in Middle School*. I understand that there are no known risks to participants in the study, that my 8th grade child is free to withdraw from participation at any time, and that any questions that I may have about the study will be answered fully by the principal investigators.

☐ I grant permission for my 8th grade son / daughter to participate.
☐ I do not grant permission for my child to participate.

Print Your 8th grade Son's / Daughter's Name	Print Your Name
Your Son's / Daughter's Signature	Your Signature

Hartford Magnet Trinity College Academy
at The Learning Corridor
Sally A. Biggs, Principal
Sheldon Neal, Assistant Principal
Gwyndolyn Adams, Assistant Principal
MariAnne Lalama

HARTFORD PUBLIC SCHOOLS
Where the future is present

Trinity College
Hartford, Connecticut

CONSENT FORM
Please return this form to Ms. Avery/Ms. Lanza

Title of Project: Self-Regulated Learning: Metacognition & Achievement in Middle School

Principal Investigators: Dina Anselmi, Ph.D.
(860) 297-2236 or Dina.Anselmi@trincoll.edu
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averd001@hartfordschools.org
Hartford Magnet Trinity College Academy, Hartford, CT 06106

Ms. Lanza
Lanzs001@hartfordschools.org
Hartford Magnet Trinity College Academy, Hartford, CT 06106

I acknowledge that I have received and read a letter explaining the study *Self-Regulated Learning: Metacognition & Achievement in Middle School*. I understand that there are no known risks to participants in the study, that my 8th grade child is free to withdraw from participation at any time, and that any questions that I may have about the study will be answered fully by the principal investigators.

☐ I grant permission for my 8th grade son / daughter to participate.

☐ I do not grant permission for my child to participate.

Print Your 8th grade Son's / Daughter's Name _____ Print Your Name _____

Your Son's / Daughter's Signature _____ Your Signature _____

Date _____

Appendix B

1. What is your birth date?

Month _____ Day _____ Year _____

2. What is your sex: □ Female □ Male

3. Which of the following groups best describes you?

(You may check more than one group, if appropriate)

□ Asian or Pacific Islander

□ Hispanic, regardless of race

□ Black / African-American, not of Hispanic origin

□ White / Caucasian, not of Hispanic origin

□ American Indian or Alaskan Native

4. In what city or town do you live?

_____

Appendix C

Instructions: We are interested in what you, as a learner, do when you work on and prepare for assignments or tests as a part of your history class. Please read the following sentences and choose the answer that relates to you and the way you are when doing work for class. Please answer as honestly as possible.

1. When I am given an assignment in this class that asks me to remember a lot of information, I can tell what works best for me to remember everything.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

2. After completing a test or assignment in this class, I think about what went well.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

3. When I have a test coming up, I do most of my studying at the last minute.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

4. I read directions more than once before I start working on an assignment.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

5. I use skills – like taking notes, asking myself questions, and slowing down – when I read for this class.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

6. I know what my strengths are on the work I do in this class.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

7. After I get an assignment back, I try to figure out how I could improve my work for next time.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

8. When I start an assignment I check that I have all the things I will need – for example, a textbook, a computer, my notes, or the assignment itself – to complete the assignment.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

9. I do not understand the purpose of assignments in this class.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

10. I review my writing for this class before I hand it into the teacher.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

11. I make an effort to examine my weaknesses on the work I do in this class.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

12. I change my ways of completing an assignment when I realize that they are not working.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

13. When I work on a writing assignment, I immediately start writing without making an outline or a graphic organizer.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

14. I READ DIRECTIONS CAREFULLY TO MAKE SURE I UNDERSTAND ALL THE DIFFERENT PARTS OF AN ASSIGNMENT.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

15. I ASK MY TEACHER FOR HELP.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

16. I CAN TELL JUST HOW MUCH TIME IT WILL TAKE ME TO COMPLETE ASSIGNMENTS IN THIS CLASS.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

17. WHEN I GET A BAD GRADE IN THIS CLASS, I DO NOT STUDY ANY DIFFERENTLY FOR THE NEXT ASSIGNMENT.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

18. WHEN MY HOMEWORK REQUIRES SPECIFIC MATERIALS, I REMEMBER TO BRING THEM HOME FROM SCHOOL.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

19. I UNDERSTAND DIRECTIONS FOR ASSIGNMENTS IN THIS CLASS.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

20. WHEN I READ FOR THIS CLASS I FIRST FOCUS ON HEADINGS, BOLD WORDS, AND SUMMARIES AND THEN READ THE MATERIAL MORE CAREFULLY.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

21. MY GRADES ON ASSIGNMENTS IN THIS CLASS ARE DIFFERENT FROM WHAT

I expect them to be.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

22. After completing a test or assignment in this class, I think about what did not work well.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

23. When I have an assignment that will be due more than a week in the future, I start working on it as soon as possible.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

24. I rush through directions to get started on a test as soon as possible.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

25. I compare my most recent grades in this class to my earlier grades in order to see if I'm improving.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

26. I know what my weaknesses are on the work I do in this class.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

27. When my teacher returns a test, I try to figure out what I didn't understand.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

28. When I have a writing assignment due, I do most of my work at

THE LAST MINUTE.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

29. AFTER I READ AN ASSIGNMENT, I MAKE SURE I KNOW WHAT THE MAIN GOAL OF THE ASSIGNMENT IS.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

30. I USE SKILLS – LIKE USING FLASH CARDS, STUDY GUIDES, AND WORKING WITH A PARTNER – WHEN I PREPARE FOR A TEST.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

31. I MAKE AN EFFORT TO EXAMINE MY STRENGTHS ON THE WORK I DO IN THIS CLASS.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

32. WHEN I GET TEACHER COMMENTS OR CORRECTIONS ON A WRITING ASSIGNMENT IN THIS CLASS, I DON'T PAY ANY ATTENTION TO THEM.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

33. I MAKE A "TO DO" LIST BEFORE I START WORKING ON AN ASSIGNMENT IN THIS CLASS.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

34. WHEN I HAVE NEARLY FINISHED AN ASSIGNMENT, I READ THE DIRECTIONS ONE LAST TIME TO MAKE SURE I HAVE COMPLETED ALL PARTS OF THE ASSIGNMENT.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

35. I TURN IN TESTS FOR THIS CLASS WITHOUT CHECKING MY ANSWERS.

1	2	3	4	5
NEVER	SELDOM	SOMETIMES	OFTEN	ALWAYS

Instructions: We are interested in what you, as a learner, do when you study for your history class. Please read the following sentences and choose the answer that relates to you and the way you are when you're doing schoolwork or homework. Please answer as honestly as possible.

1. I know when I understand something.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

2. I can make myself learn when I need to.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

3. I try to use ways of studying that have worked for me before.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

4. I know what the teacher expects me to learn.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

5. I learn best when I already know something about the topic.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

6. I draw pictures or diagrams to help me understand while learning.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

7. When I am done with my school work, I ask myself if I learned what I wanted to learn.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

8. I think of several ways to solve a problem and then choose the best one.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

9. I think about what I need to learn before I start working.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

10. I ask myself how well I am doing while I am learning something new.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

11. I really pay attention to important information.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

12. I learn more when I am interested in the topic.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

13. I use my learning strengths to make up for my weaknesses.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

14. I use different learning strategies depending on the task.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

15. I occasionally check to make sure I'll get my work done on time.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

16. I sometimes use learning strategies without thinking.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

17. I ask myself if there was an easier way to do things after I finish a task.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

18. I decide what I need to get done before I start a task.

1	2	3	4	5
Never	Seldom	Sometimes	Often	Always

Appendix E

Teacher name _____

Block A B C D E

Teacher Rating of Student Metacognition

Metacognition refers to reflecting on and directing one's own thinking to become a more effective learner. Listed below are several behavior descriptors that would distinguish students who are LOW and HIGH in metacognition. Using the following scale below, rate each student in your class regarding your best judgment of his or her level of metacognition and assign a number for that student's level of metacognition.

LOW Metacognition
1. Misunderstands purpose of assignments or tests
2. Overestimates strengths and weaknesses when preparing for a test or assignment
3. Does not plan purposefully for assignments or tests
4. Does not monitor own performance
5. Unwilling or unable to adjust based on feedback or self reflection

HIGH Metacognition
1. Understands purpose of assignments or tests
2. Accurately estimates strengths and weaknesses when preparing for a test or assignment
3. Plans purposefully for assignments or tests
4. Monitors own performance
5. Willing or able to adjust based on feedback or self reflection

Level of Metacognition

Student name	Very low					Very high
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**

Appendix F

1. Compared with other students in this class I expect to do well.
   1 2 3 4 5 6 7

   Not at all true of me — Very true of me

2. I'm certain I can understand the ideas taught in this course.
   1 2 3 4 5 6 7

   Not at all true of me — Very true of me

3. I expect to do very well in this class.
   1 2 3 4 5 6 7

   Not at all true of me — Very true of me

4. Compared to others in this class, I think I'm a good student.
   1 2 3 4 5 6 7

   Not at all true of me — Very true of me

5. I am sure I can do an excellent job on the problems and tasks assigned for this class.
   1 2 3 4 5 6 7

Not at all true of me — Very true of me

6. I think I will receive a good grade in this class.
   1 2 3 4 5 6 7

Not at all true of me — Very true of me

7. My study skills are excellent compared with others in this class.
   1 2 3 4 5 6 7

Not at all true of me — Very true of me

8. Compared with other students in this class I think I know a great deal about the subject.
   1 2 3 4 5 6 7

Not at all true of me — Very true of me

9. I know I will be able to learn the material for this class.
   1 2 3 4 5 6 7

Not at all true of me — Very true of me

Appendix G

Instructions: Read each sentence below and select the answer that shows how much you agree with it. There are no right or wrong answers.

1. You have a certain amount of intelligence, and you really can't do much to change it.

1	2	3	4	5	6
Strongly Agree	Agree	Mostly Agree	Mostly Disagree	Disagree	Strongly Disagree

2. Your intelligence is something about you that you can't change very much.

1	2	3	4	5	6
Strongly Agree	Agree	Mostly Agree	Mostly Disagree	Disagree	Strongly Disagree

3. You can learn new things, but you can't really change your basic intelligence.

1	2	3	4	5	6
Strongly Agree	Agree	Mostly Agree	Mostly Disagree	Disagree	Strongly Disagree

4. No matter who you are, you can change intelligence a lot.

1	2	3	4	5	6
Strongly Agree	Agree	Mostly Agree	Mostly Disagree	Disagree	Strongly Disagree

5. You can always greatly change how intelligent you are.

1	2	3	4	5	6
Strongly Agree	Agree	Mostly Agree	Mostly Disagree	Disagree	Strongly Disagree

6. No matter how much intelligence you have, you can always change it quite a bit.

1	2	3	4	5	6
Strongly Agree	Agree	Mostly Agree	Mostly Disagree	Disagree	Strongly Disagree

Appendix H

Teacher name _____

Block A B C D E

Teacher Rating of Student Mindset

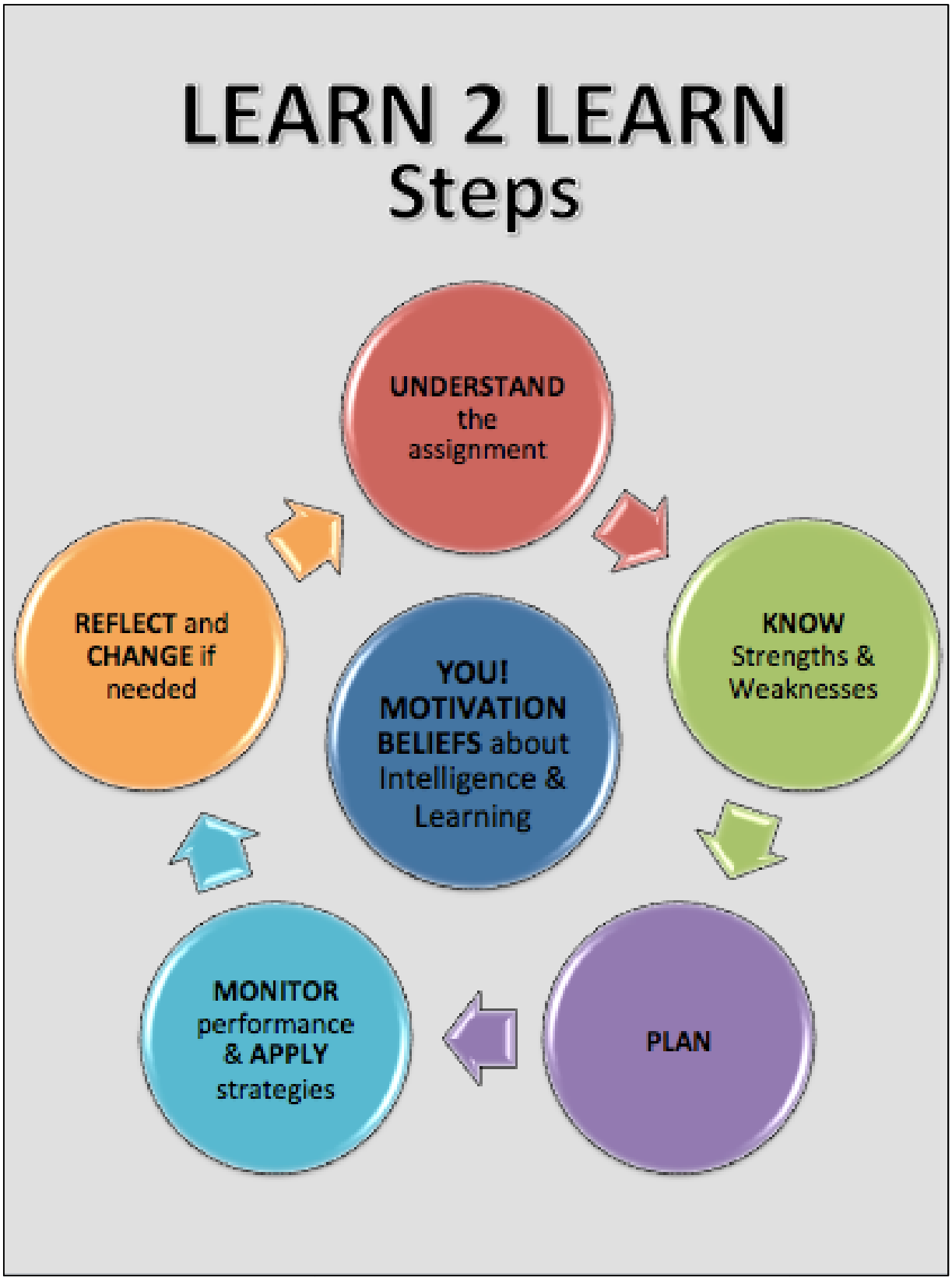
There are two main types of beliefs about the modifiability of one's intelligence. Someone with a FIXED MINDSET believes that intelligence is static and desires to look smart. On the other hand, a person with a GROWTH MINDSET believes that intelligence can be developed and desires to learn. Using the following scale below, rate each student in your class regarding your best judgment of his or her type of mindset and assign a number for that student's level of intelligence beliefs.

Fixed Mindset
1. Avoids challenges
2. Gives up easily
3. Sees effort as fruitless or worse
4. Ignores useful negative feedback
5. Feels threatened by the success of others

Growth Mindset
1. Embraces challenges
2. Persists in the face of setbacks
3. Sees effort as the path of mastery
4. Learns from criticism
5. Finds lessons and inspiration in the success of others

	Type of Mindset					
Student name	Fixed					Growth
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**
_____	**1**	**2**	**3**	**4**	**5**	**6**

Appendix I


LEARN 2 LEARN
Steps
UNDERSTAND the assignment
KNOW Strengths & Weaknesses
PLAN
MONITOR performance & APPLY strategies
REFLECT and CHANGE if needed
YOU! MOTIVATION BELIEFS about Intelligence & Learning

Appendix J

Directions:

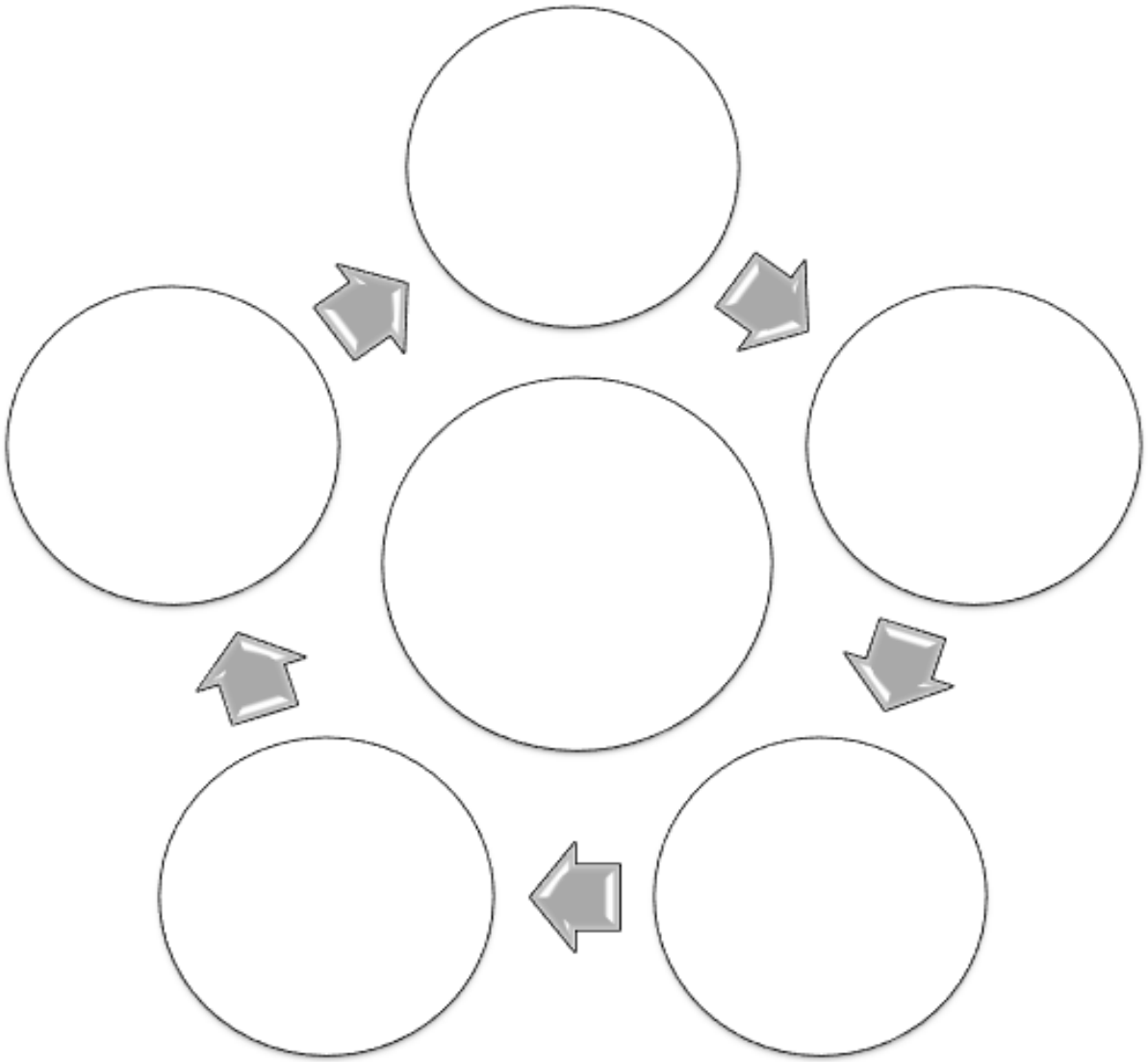
1. Each team has been given 18 marshmallows and 30 toothpicks
2. Your team's goal is to build the tallest tower possible!
3. The tower must be able to stand on its own without any helping hands or another object (freestanding). This means no holding the tower or leaning it against another object
4. Each team will be given 10 minutes to build their tower.

Appendix K

LEARN 2 LEARN Steps:
Building a Structure in Groups

Team Name: _____
Members :_____

After building the structure, discuss with your team what you did, thought of, or talked about as a group that would match each one of the *LEARN 2 LEARN Steps*. Make sure you write something for ALL the steps!



Appendix L

Name: _____ Block: ____

LEARN 2 LEARN QUIZ

Directions: Based on the activity we did in class and the steps we discussed with you – try your best to match the definitions on the right with the correct step on the left. Write the corresponding letter in the blank next to the step.

____ Planning	a. Putting your plan into action and then checking your progress to see how you are doing
____ Assess the Task	b. What makes you want to do something or not want to do something
____ Monitor Performance and Apply Strategies	c. Thinking about what you are good at and what you struggle with when doing an assignment
____ Evaluating Strength and Weaknesses	d. Developing a series of steps to tackle an assignment before you start
____ Reflect and Adjust	e. Knowing what strategies work for me and if a strategy does not work for me, trying a different one
____ Motivation	f. Reading directions and understanding the goal of an assignment

Appendix M

LEARN 2 LEARN:
Building a Structure that Supports Weight

Next week we will be building another tower (so make sure to read the directions below carefully). Fill out the Learn 2 Learn steps based on this new task and bring them in by Monday.

Directions: Each team will be given the same time and materials to complete the task. Your team's goal will be to build a tower strong enough to hold your empty Learn 2 Learn binder. Again, the tower must be able to stand on its own without any helping hands or another object (freestanding).

UNDERSTAND the assignment	
KNOW Strengths & Weaknesses	
PLAN	
MONITOR performance **& APPLY** strategies	
REFLECT and **CHANGE** if needed	
MOTIVATION BELIEFS about Intelligence & Learning	

Appendix N

Name:_____ Block:____

LEARN 2 LEARN:
Applying the steps to your homework

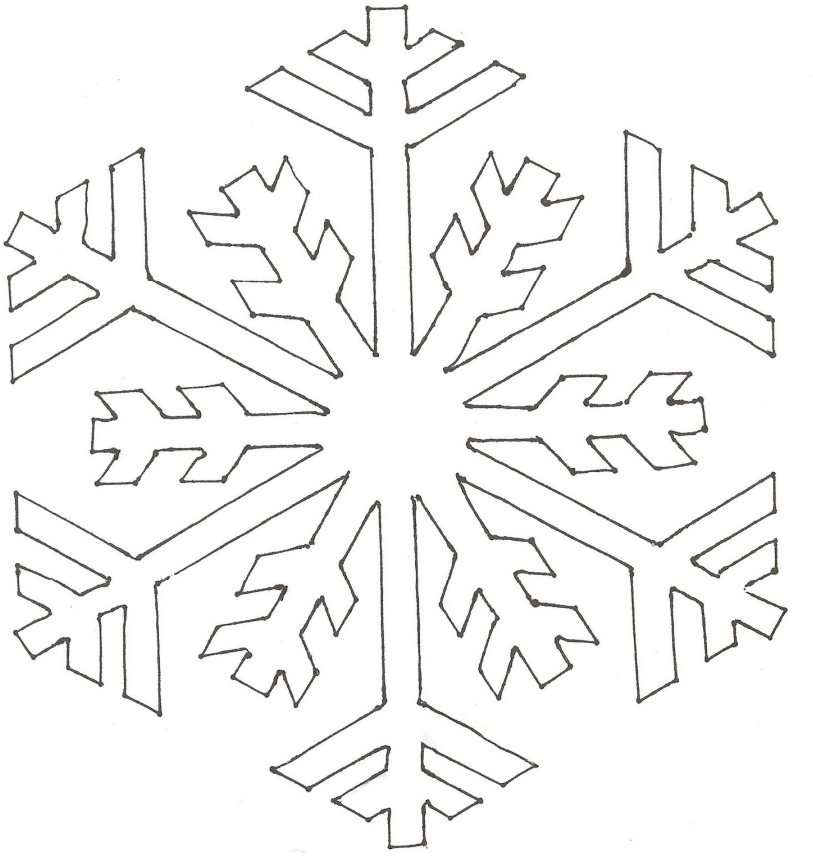
Directions: Explain how the 6 LEARN 2 LEARN steps apply to the homework assignment chosen by your history teacher. Assignment:_____. Due by Monday 11/02/2013.

UNDERSTAND the assignment	_____ _____ _____
KNOW Strengths & Weaknesses	_____ _____ _____
PLAN	_____ _____ _____
MONITOR performance **& APPLY** strategies	_____ _____ _____
REFLECT and **CHANGE** if needed	_____ _____ _____
MOTIVATION BELIEFS about Intelligence & Learning	_____ _____ _____

Appendix O

LEARN 2 LEARN

Winter Booklet



Name: _____

Block: ___

Check the activities that you have completed:

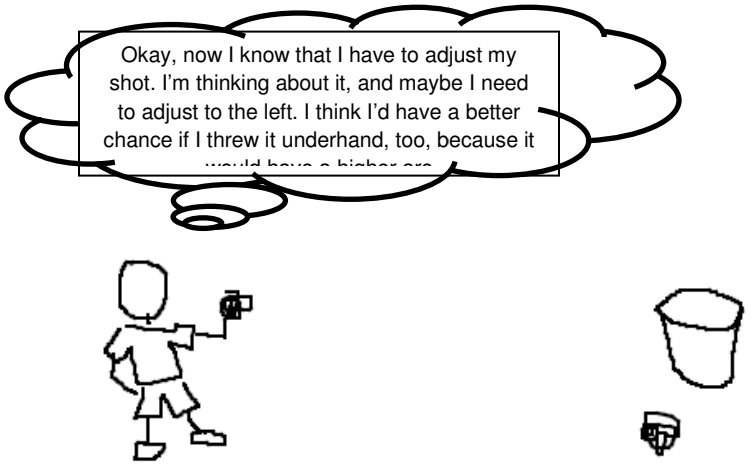
- ○ 1. “Thinking about Thinking”
- ○ 2. Jesse’s History Paper
- ○ 3. Alex’s History Paper
- ○ 4. “Stepping in their shoes”

ACTIVITY #1
THINKING ABOUT THINKING

DIRECTIONS:
Please read the 6 scenes of Peter's story and answer ALL the questions.

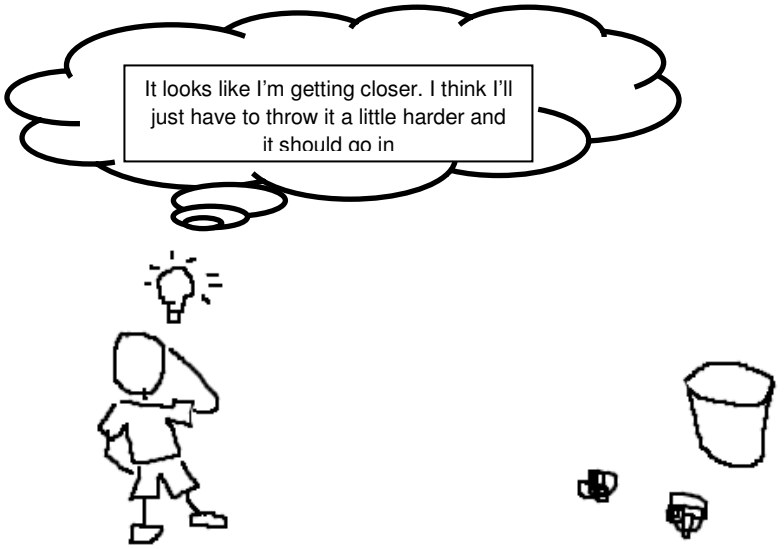
SCENE 1.
Peter crunches up a piece of paper, throws it, and misses the garbage can. The paper falls to the right.

SCENE 2.



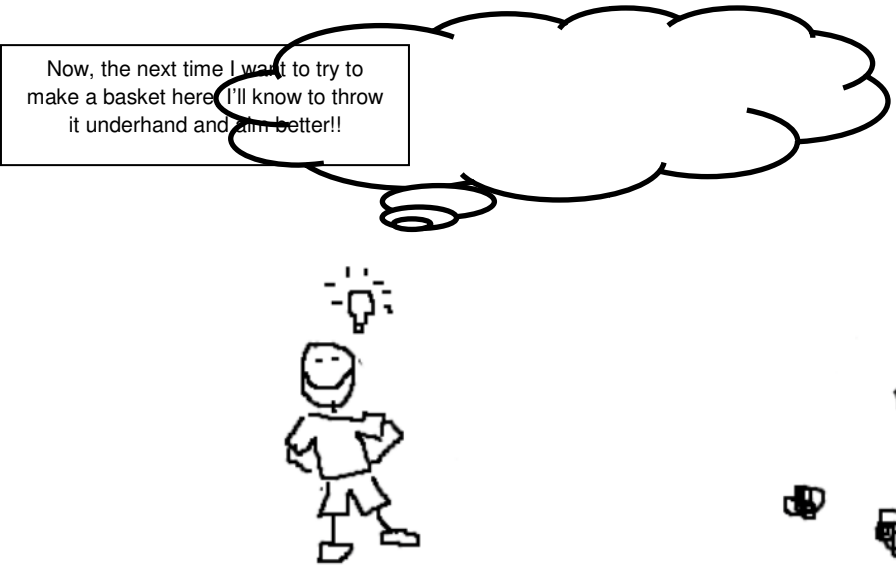
SCENE 3.
Peter crunches-up another sheet of paper, throws it, and it lands just short, hitting the rim of the can.

SCENE 4.



SCENE 5. Peter gets another piece of paper, and throws it — bulls-eye!

SCENE 6.



QUESTIONS:

1) What was Peter's mistake at the beginning?

_____

_____

_____

_____

2) What did he do differently in order to make a basket?

_____

_____

_____

_____

3) What is the main lesson of the story?

_____

_____

_____

_____

ACTIVITY #2
JESSE'S HISTORY PAPER

DIRECTIONS:

Please read Jesse's story and answer ALL the questions.

Jesse's history Professor at Trinity started the class announcing that they were being assigned a paper on the Civil War. Jesse was handed a sheet with directions for the assignment and its due date, which he quickly skimmed while talking to one of his friends. The following week he ran into Alex who was in the same History class. Alex asked Jesse how he was doing with the paper, which he had completely forgotten about. He then realized that the paper was due in one week.

Swamped with assignments for other classes, Jesse had to start working on the paper the day before it was due. Since it was a paper that required a lot of work and research, Jesse had to stay up all night working on it. Doing the research and readings took up a lot of time so he wasn't able to write out an outline for the paper, and had to jump right into the writing. He had a lot of ideas and knew what he wanted to write, but didn't know how to organize it. He was able to write just the right number of pages but was hesitant that he had included everything the professor had asked for. Rushing to finish it on time, he was unable to proofread it before handing it in for a grade.

QUESTIONS:

1) Did Jesse read directions and understand his assignment? (Circle one)

YES NO

2) Did Jesse plan well for his paper? (Circle one)

YES NO

(See next page)

3) Did Jesse check his progress to see how he was doing along the way? (Circle one)

YES NO

4) Did Jesse use any sort of strategies to help himself complete the assignment

efficiently?

YES NO

If yes, explain what strategies he used…

_____
_____
____

5) Do you think Jesse should have done anything differently? If yes, explain.

_____
_____
____
_____
_____
____

ACTIVITY #3
ALEX'S HISTORY PAPER

DIRECTIONS:

Please read Alex's story and answer ALL the questions.

Alex's history Professor at Trinity began class with the announcement that they were being assigned a paper. Alex was handed directions for the paper from his Professor and began to read carefully. He read that the paper would be due in 2 weeks and was on the Civil War. He immediately took out his planner and wrote down when the paper was due.

After class, Alex went back to his room and began to write out a plan for the next two weeks. He knew that he had two other papers and another big project to do before the end of the year and would have to manage his time well. He decided to spend an hour on the paper every day. He first began by doing research on the subject until he was ready to make an outline of everything he planned to write about. After making an outline, he realized his paper was going to be too long and needed to be shortened. He took out some of the information he believed to be irrelevant and started to write the paper. He was done two days early, giving him plenty of time to read the paper over for spelling mistakes before handing it in for a grade.

QUESTIONS:

1) Did Alex read directions and understand his assignment? (Circle one)

YES NO

2) Did Alex plan well for his paper? (Circle one)

YES NO

(See next page)

3) Did Alex check his progress to see how he was doing along the way? (Circle one)

YES NO

4) Did Alex use any sort of strategies to help himself complete the assignment efficiently?

YES NO

If yes, explain what strategies he used…

_____
_____
_____

5) Do you think Alex should have done anything differently? If yes, explain.

_____
_____
_____
_____
_____
_____

ACTIVITY #4
STEPPING IN THEIR SHOES

DIRECTIONS:

Imagine that you have to write the same paper as Alex and Jesse about the Civil War for your History class. Please re-read Alex & Jesse's stories and answer ALL the following questions.

QUESTIONS:

1) What would you do differently than Alex?

_____

_____

____

2) What would you do differently than Jesse?

_____

_____

____

3) What would you do similarly to Alex?

_____

_____

____

4) What would you do similarly to Jesse?

_____

_____

5) Do you think Alex applied (most, if not all) the Learn 2 Learn steps when he was writing his paper? (Circle one)

YES NO

If yes, give some examples:

_____

_____

_____

(See next page)

6) Do you think Jesse applied (most, if not all) the Learn 2 Learn steps when he was writing his paper? (Circle one)

YES NO

If yes, give some examples:

_____

_____

_____

7) What are some things that might make it hard to apply the Learn 2 Learn steps to your schoolwork?

_____

_____

_____

Appendix P

For me, what makes learning the hardest is…

_____

_____

_____

Appendix Q

MY *Learn 2 Learn* GOALS

I (_____) will make an effort to not be a distraction to my classmates, in order to make learning easier for everyone!

My short-term goal is…

_____

_____

_____

_____

_____

My long-term goal is…

_____

_____

_____

_____