THE EFFECTS OF DIRECT INSTRUCTION OF METACOGNITIVE SKILLS THROUGH SELF-REGULATED LEARNING AND SELF-EFFICACY DEVELOPMENT IN THE MATHEMATICALSCIENCES

by

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ABSTRACT

This study explored how direct instruction of metacognitive processes through self-efficacy and self-regulated learning skills impacts student ability to independently and intrinsically drive academic growth to move through the novice to mastery continuum. This goal was to provide students with the skills and practices to foster perseverance, confidence, self-regulation, and sense of agency throughout the learning process. The treatment was implemented with a sixth-grade study skills class with a contextual practice component integrated in math. Content mastery changes were assessed through math topic assessments. Self-efficacy and metacognition changes were evaluated through interviews, open-response questions, interactive notebook entries and self-confidence surveys for growth mindset and self-regulated learning. Results were statistically insignificant. Even though there was minimal or arguable quantitative evidence of change in student practice and behavior, there were positive results. There is some evidence suggesting an improvement in student ability to articulate areas of weakness and utilize strategies to improve academic performance. While average test scores did not increase, there was an improvement in normalized gains, especially in the lower to mid-performing sub-groups. This indicates movement toward content mastery.

INTRODUCTION

Over my years as an educator, I have observed students struggling with independence in their learning due to an inability to accurately articulate areas of weakness as well as identify and utilize resources or strategies to adjust their misconception or lack of understanding. Students may be able to state an area of weakness but cannot create meaningful strategies. For example, students may state that they have difficulty with division of fractions but cannot explain the specific breakdown in understanding. A student-derived solution might be "study more"; however, ultimately, they don't know what "study more" entails. This disconnect became evident in a self-confidence survey completed by my sixth-grade science students during the 2017/2018 school year.

My Action Research project studied the effects of systematic and direct instruction of self-efficacy (growth mindset development) and self-regulated learning (metacognition) skills on student self-sufficiency, self-confidence, and intrinsically driven academic growth. More specifically, I explored the following questions.

- How does the treatment impact the student's ability to articulate areas of confusion or weakness as well as identify and utilize strategies to influence academic performance and content mastery?
- How does the treatment impact self-efficacy and metacognition? If so, how does self-confidence impact the ability to independently drive learning?
- How does the treatment impact my ability to foster a learner-centered classroom? Students direct and manage their own learning; the teacher is the facilitator of learning.

Throughout my teaching career I have attempted several different methods to develop independent and intrinsically motivated students. I hadn't found a successful formula or strategy for reaching this goal and realized a key piece my efforts had neglected the specific and systematic direct-instruction of metacognition skills. I made many inaccurate presumptions about student metacognitive development. I neglected to appropriately scaffold and nurture these skills.

The purpose of this project was to provide a metacognition skill framework for students to articulate and understand areas of weakness as well as identify and utilize procedures and strategies to independently drive their own learning to move through the novice to mastery continuum. Specific metacognition strategies include; development of self-awareness, identification and use of multiple strategies, organization, establish and monitor goals, and evaluation/reflection. Metacognition skills coupled with self-efficacy allows students to have the confidence to drive their own learning by monitoring volition (emotional state and mindset). This intrinsically driven belief nurtures perseverance, confidence, self-regulation, and sense of agency throughout the learning process. First and foremost, this project was to provide a means of academic self-determination for my students. Secondly, I hope results can direct my school in the use of self-efficacy and self-regulated learning frameworks in all grade levels to facilitate the mindset change of mastery-based learning, which requires students to be more independent and intrinsically driven learners.

My support team was composed of three work colleagues. The principal and vice-principal (each have a MA in Education Leadership and Administration) provided outside

observations of student performance and gave feedback of my efficacy in facilitation of the curricular programs. The vice-principal helped me review my data to discuss possible interpretation of student responses or change in performance. The middle-school language arts teacher edited and provided feedback on my written work.

CONCEPTUAL FRAMEWORK

The essential framework for my understanding of how humans grow and intellectually evolve is through the lens of Constructivism as presented by John Dewey, Jean Piaget, and Lev Vygotsky (Llewellyn, 2014). Simply stated, Constructivism is an educational theory that asserts learning is a collaborative, discovery-based process that is adaptive, self-reflective, and self-driving. John Dewey postulated that intellectual disequilibrium drives the learning process through the interplay of existing mental models and new informational contexts. The mind engages in a continual process of placing and replacing information to develop equilibrium of knowledge. Jean Piaget defines the mental models as schema and furthers Dewey's work by claiming that learning is a socially collaborative, discovery-based process that is adaptive, self-reflective, and self-driving. Lev Vygotsky's work states that the learner is moved from disequilibrium to equilibrium through the individual's Zone of Proximal Development via a scaffold-driven process.

In my project, I used the lens of Constructivist Theory to develop self-efficacy and self-regulated learning. Metacognition is the internal cyclical processes of planning, monitoring, and assessing understanding and performance. It is the critical awareness of thinking and learning. Students who are proficient with metacognitive functions can

flexibly transfer knowledge and develop their schema (Bransford, 1984). They know different strategies for learning, thinking, and problem solving (Pintrich, 2002). Self-efficacy is confidence in one's own abilities, and, subsequently, plays a significant role in developing proficiency with metacognition (Bandura, 1992). Low self-efficacy limits the ability of the individual to set goals, complete tasks, and persevere in novel and challenging scenarios (Bandura, 1992).

Low achievers struggle not only with lack of content knowledge, but also low motivation due to low self-efficacy, and lack of skills to self-regulate (Sufen, 2016). Self-regulation in learning requires metacognitive skills and internal motivations (beliefs, goals, and dispositions) to determine learning outcomes (Zapeda, 2015). A self-regulated learner has the ability to use existing strategies and seek out different strategies when needed, set high goals, and be persistent when faced with challenges (Sufen, 2016). To develop self-sufficient and independently driven learners, it is necessary to develop awareness of strategies for improving self-efficacy and to develop the knowledge and skill set of self-regulation in learning/metacognition. I integrated the interdependent strands of developing self-efficacy through the lens of growth mindset and metacognition through self-regulated learning to answer the questions set forth in this project.

Self-Efficacy

Carol Dweck's work on Implicit/self-theories is the guiding work that I used to cultivate self-efficacy. Dweck's self-theories describe how we think of ourselves as learners. Do we have a growth or a fixed mindset? There are two types of learners; Incremental and Entity. Incremental Learners (growth mindset) engage in a mastery approach to learning. They understand that struggle and challenge are part of the learning process and are willing to persevere in the struggle because they have an intrinsic belief in themselves as learners. In contrast, Entity Learners (fixed mindset) engage in a performance-based approach to learning. Students with this mindset believe that performance is for an external audience where the goal is to showcase abilities, not master content. This leads to a need for high extrinsic motivation (Dweck, 2000). Students who do not feel that they can do well will not persevere or even attempt to achieve learning goals. Students who have a growth mindset have resilience, perseverance, and motivation. They demonstrate an intrinsically motivated willingness to engage in a task.

Self-efficacy is not inherent, it is a nurtured, practiced, and evolving process (Ng, 2017). In Betsy Ng's work, she explored the neuroscience behind growth mindset using cognitive function (attention, memory, and decision making) analysis. Her research found that students who were intrinsically motivated experienced heightened levels of excitement in dopamine neurons when exposed to novel or challenging tasks. She discovered that those who experience reward from tasks seek similar experiences in the future, while those who don't will be less willing to seek out related opportunities. Additionally, those with growth mindset also demonstrated greater brain activity in the

frontal cortex of the brain when given negative feedback signaling heightened awareness and attention to both task and feedback. This is a positive internal feedback loop between motivation, self-efficacy, and learning. Ng argues that because of the neuroplasticity of our brains, we can, in a sense, shape minds to become more intrinsically driven with growth-mindset interventions

To provide the growth-mindset interventions, it is important to understand the role of the teacher and effective instructional strategies. The teacher has five basic roles (Seaton, 2018). First, it is necessary to provide direct instruction of qualities and characteristics of growth versus fixed mindsets. Second, there must be a strong and positive teacher-student relationship that builds trust and emotional durability. Third, the teacher provides specific and appropriate feedback that acknowledges specific growth and areas to grow rather than performance feedback. Fourth, the teacher explicitly models metacognition. Fifth, cognitive dissonance is valued and explored through explicit self-reflection instruction (Seaton 2017). Effective strategies include guided analysis of mindsets and self-assessment as well as frequent modeling of self-reflection. More importantly, it is important to incorporate frequent guided reflection using the following model: description of event, evaluation of feelings, evaluation of event, analysis of what happened, and analysis of next steps (Seaton, 2018).

Self-Regulated Learning

To foster metacognition and independence in learning, I used Barry Zimmerman's social cognitive theory of the cyclical phase model of Self-Regulated Learning (Zimmerman, 2008). Evidence shows that students who set learning goals, identify and

use strategies to achieve their goals, and utilize reflective practices see greater intrinsic value in tasks and have greater resiliency regarding academic failure because they view failure as a learning opportunity (Pandero, 2014). This feedback-loop model includes three essential phases: forethought, performance, and self-reflection.

The forethought phase consists of two primary goals: task analysis and assessment of self-motivation beliefs. During task analysis, students assess the task, set performance goals, and strategically plan how to meet their goals. The second part is an assessment of self-motivation beliefs. Students evaluate their self-efficacy, outcome expectations (probability of success), task value (relevance to personal goals), and goal orientation (belief about the purpose of learning: mastery versus performance). Results of research by Pandero and Alanso-Tapis suggests successful students spend more time in the forethought phase. (Pandero, 2014).

Phase two is the performance; students participate in self-observation and monitor self-control of the task. During self-observation, students monitor metacognition by assessing progress and making appropriate adjustments to strategies and learning plans. Self-control of the task is the ability to identify and utilize executive functions. This involves identification of strategies, self-instruction (finding and using resources), time management, environmental structuring (hunger, temperature, noise level, physical comfort), help seeking, identifying incentives, and establishing self-rewards and consequences.

Phase three is self-reflection phase; students evaluate self-judgement, self-reaction, and identify future adaptations. Self-judgement involves assessment of task product or

learning against criteria and determines reasons for success or failures. Self-reaction is the personal reaction to self-judgement; it is the personal beliefs and cognitive reactions produced by self-judgement that have an impact on future motivations. Future adaptations are based on self-reaction. Students identify learning strategies that are supportive or distracting and identify emotions related to performance that drive self-efficacy.

The principle critique to Zimmerman's social cognitive theory on self-regulation is that Zimmerman's model neglects student volition, or emotional state orientation (Pandero, 2014). Zimmerman's theory of self-regulation is dependent upon action orientation; each process is driven by rational and result driven processes. Using the theory of emotional orientation, each phase is not autonomous, and the individual's emotional state is also a factor in self-regulation. There are four psychological processes bound by emotional state orientation; attention control, motivation control, emotion control, and failure control. Attention control is the ability to avoid distraction and attend to relevant information. Motivation control is dependent upon the self-valued understanding of the goal. Emotional control is the ability to remove negative feelings toward the goal that interfere with motivation and attention. Failure control is the ability to see that failure and struggle are essential components of learning experiences.

These psychological processes must be acknowledged and addressed before rational progression through the phases of self-regulation can occur. The individual's emotions will limit progress within self-regulation. Results of Mega et all suggest that negative emotions have greater impact on students with performance-based expectations than those with mastery-based expectations (Mega, Ranconi, & De Beni, 2014). More

importantly, self-regulated learning will not occur in a low-motivation environment. The purpose of incorporating self-regulated learning with self-efficacy development through growth mindset is to bridge the gap between rational and emotional influences affecting an individual's ability to self-regulate.

METHODOLOGY

This study used a two-fold approach to develop metacognitive processes through direct instruction of self-efficacy (growth mindset development) and metacognition skills (self-regulated learning) to increase student self-sufficiency, self-confidence, and intrinsically driven academic growth. The research methodology for this project received an exemption from Montana State University's Institutional Review Board and compliance for working with human subjects was maintained (Appendix A).

Treatment was implemented with a sixth-grade study skills class with a contextual practice component integrated in the sixth-grade math class. The class was composed of 25 students: 16 girls and nine boys. Sixty-five percent of the students come from homes with at least one parent having some post-high school education (trade school, community college, or university/4-year College), and nine qualify for free and reduced lunch. The fall benchmark math MAP test was used to identify ability groups using the Percentile Rank measure; this is a score based on ranking compared to an age-grouped norm. There was a wide range of ability levels within the classroom: 26% of students scored in the +80% range; 32 % in the 50 – 79 percent range; and 42 % were below 50%. This class has a higher level of motivation and desire to achieve mastery of academic standards.

Instructional Methods

The self-regulated learning and growth mindset progressions were designed as twelve-week courses using one to two class periods per week for each curriculum. One to two days per week were dedicated to self-efficacy, with additional days dedicated to self-regulated learning. Each topic ranged in duration from 20 – 60 minutes.

Three components were used to support the overall scaffolding of skills and mindsets. Students participated in direct instruction and practice opportunities to develop self-efficacy mindset and self-regulated learning in course specific and non-course contexts. Students maintained an executive functioning interactive notebook related to growth (self-efficacy) and self-regulated learning. Additionally, self-efficacy and self-regulated learning reflections and processes were integrated within course specific learning. Lastly, the class culture and structure integrated self-efficacy and self-regulated learning processes into all facets of classroom life.

I chose the component in math because there are well-established assessments, strategies, and resources making it easier to identify areas of weakness and utilize strategies and resources to improve.

Self-Efficacy

Instruction of growth mindset was adapted from *The Growth Mindset Coach: A Teacher's Month-by-Month Handbook for Empowering Students to Achieve* (Brock & Hundley, 2017). The framework provided students with an opportunity to develop familiarity of fixed and growth mindsets, self-awareness of current mindset, neuroscience of brain plasticity, and use of failure as a learning tool. Weekly lessons included a formal

overview and topic discussion, an activity to develop a contextual understanding of the topic, and an interactive notebook prompt for guided reflection.

Students maintained a daily math interactive notebook. Daily notebook entries included an "Essential Question" addressing concepts covered in the lesson. The "Essential Question" also served to assess concept understanding before students moved to independent practice. Students monitored and traced mindset and emotions via daily math interactive notebook entries using the following model: evaluation of the event, feeling associated with the event, and analysis of next steps. The following example illustrates the expected entry format: "I was anxious when I couldn't understand how to divide using the area model. I was confused with how to set up the dividend and the divisor. I need to look at other examples from our notes and practice more problems so that I become comfortable."

In addition, I used formal and informal opportunities to model and engage in discussion about emotions and self-belief within content instruction and situational contexts. The purpose was to model my own emotions and beliefs as well as build a classroom culture that supports and embraces struggle as an essential component of growth. The hope was that students would begin to understand that failure is a part of the learning process and can be used as a reflective tool to develop content mastery.

Self-Regulated Learning

Self-regulated learning followed the same structure of self-efficacy. Self-regulation was modeled and embedded in the classroom culture, and students recorded structured learning opportunities and guided reflection in the executive functioning math interactive notebook.

Students used the executive functioning interactive notebook to record and practice the feedback-loop structure of self-regulated learning. On a weekly basis, students engaged with direct instruction of the process and strategies outside of course contexts using a variety of challenges and scenario such as CSI challenges (handwriting analysis, fingerprint classification, change blindness) through STEM-Works (STEM-Works, 2019).

Students engaged in self-regulation using math interactive notebooks through a short-form process. For example, each daily math interactive notebook entry included an essential question and learning criteria to prompt the forethought phase. The class developed a communal strategy and resource list to accomplish learning goals and record performance phase assessments. Upon completion of individual or group activities, students recorded their self-reflection of topic mastery, identified areas of confusion, formulated a list of resources used to clarify confusion, and identified new strategies that they would like to try in the future.

As with self-efficacy, both formal and informal opportunities were used to model and engage in discussion about the phases of self-regulated learning within content instruction and situational contexts. The purpose was to model my own process and metacognition as well as build a culture that supported and engaged in the process defined

in Zimmerman's model. Modeling opportunities were present within daily assignments and in the context of labs and extended projects. For example, in the context of a daily math lesson, I led students through an example of how I work through the forethought, and performance phases; I then modeled the reflection phase the following day. After each modeling opportunity, I provided students with the opportunity to create their own narrative of each phase. This provided guided and independent opportunities to practice working through the phases of self-regulated learning.

Data Collection Methods

This project was completed between September 2018 and March 2019 and was comprised of one baseline (non-treatment) unit, and one treatment unit. The baseline was established with pre-treatment Topic 1 assessments and results of self-regulated learning and growth mindset surveys. Treatment coursework began at the start of the second math topic and continued through the fourth math topic. Treatment unit data consisted of topic assessments and post-treatment results of the self-regulated learning and growth mindset surveys.

I used a data collection matrix to ensure methodologies were answering my research questions (Appendix B). Pre- and post-treatment topic assessments measured content mastery, while student perspectives and perceptions of self-efficacy, self-regulated learning, and growth were evaluated through student interactive notebooks, surveys and open-ended responses.

To assess self-efficacy, I adapted a survey designed by Mindset Works to use more kid-friendly terminology and contexts (Appendix C). Mindset Works is an online

program for developing growth mindset based on the work of Carol Dweck and Lisa Blackwell. The Growth Mindset Confidence Survey was administered, pre and post-treatment, via a Google Form to all 25 students in the study. The confidence survey was composed of seven multiple choice questions to assess student belief of aptitude (choice and non-choice talents) and effort. Answers were assigned numeric values of 1 to 5; with 1 a strong leaning toward a fixed mindset, 5 a strong leaning toward a growth mindset, and 3 a neutral mindset: neither fixed or growth.

The Self-Regulated Learning Assessment Survey was administered pre and post-treatment via a Google Form to all 25 students in the study (Appendix D). The self-regulated learning survey was adapted from the Learning and Study Strategies Inventory-LASSI (Weistein, Schulte, & Palmer, 1987). The Likert scale survey was composed of 17 statements with five possible responses ranging from “Not like me at all” to “Very much like me”, and was aimed to address: self-awareness, strategies, goal setting and planning, organization, and self-reflection/evaluation. All statements were about a strong self-confidence of skills, beliefs, or strategies.

A third-party observation tool was used to assess my competency to structure a learner-centered classroom where students drive their own learning. This tool was composed of three parts: frequency of observed behavior, observation notes, and a learner-centered classroom rubric. In the frequency observation, the recorder noted, at ten-minute intervals, the estimated percentage (25%, 50%, 75%, 100%) of students participating in a behavior. Observation notes included questions concerning the lesson, teacher facilitation role, and student engagement. The rubric assessed the role of the teacher as facilitator and

structure of the classroom culture (learner-centered or teacher-centered). The observations were completed pre, mid, and post treatment.

Pre- versus post-summative assessments for each unit of study in math were used to determine content area growth and pre and post-treatment survey results were used to determine changes in student perceptions. Content area growth was analyzed through normalized gains distributions and a t-test analysis of pre and post-treatment assessments. Wilcoxson's Rank Sum test was used to determine survey question validity, and pre and post-treatment survey distributions were compared to determine changes in student perception of confidence. These assessments were used in conjunction with interviews, interactive notebooks and open-ended survey responses to evaluate self-efficacy and self-regulated learning. An additional comparison of self-efficacy and self-regulated learning against content area growth was used. Lastly, my presentation efficacy was evaluated by a third-party before, during, and at the end of treatments (Appendix E). Reliability and validity were addressed by using and modifying pre-existing instruments. Triangulation and peer review were used in cases where teacher-created instruments were used.

DATA AND ANALYSIS

The purpose of the Action Research project was to explore the effects of direct instruction of metacognitive processes through self-efficacy and self-regulated learning on student self-sufficiency, self-confidence, and intrinsically driven academic growth. I explored the following questions.

- How does the treatment impact the student's ability to articulate areas of confusion or weakness as well as identify and utilize strategies to address identified areas of weakness influence academic performance and content mastery?
- How does the treatment impact self-efficacy and metacognition? If so, how does self-confidence impact the ability to independently drive learning?
- How does the treatment impact my ability to foster a learner-centered classroom? Students direct and manage their own learning; the teacher is the facilitator of learning

I used the pre- and post-topic assessments, surveys, and observational data to evaluate each research question (N=25). Data was analyzed for the group as a whole and sub-groups as defined in the Methodology section of this paper.

Because self-efficacy and self-regulation are so integrally connected, I chose to analyze the first two sub-questions together: how academic performance and content mastery were impacted by the ability to identify areas of weakness and utilize a variety of strategies to improve performance. I also examined how self-efficacy and self-regulation effected student ability to independently drive the learning process

Academic performance and content mastery were measured through pre and post-treatment topic assessments outlined in the Pearson Realize/ Envision math program as well as score distribution and normalized gains distribution. (Table 1 & Figure 1)

Table 1
Class Average Normalized Gains from Pre- to Post- Topic Assessments

Topic	Pre-Average (%)	Post-Average (%)	Normalized Gains
Topic 1 – Use Positive and Rational Numbers	68	85	0.34
Topic 2 – Integers and Rational Numbers	69	80	0.43
Topic 3 – Numbers and Algebraic Expressions	64	82	0.46
Topic 4 – Represent and Solve Equations and Inequalities	67	85	0.44

(*N*=25)

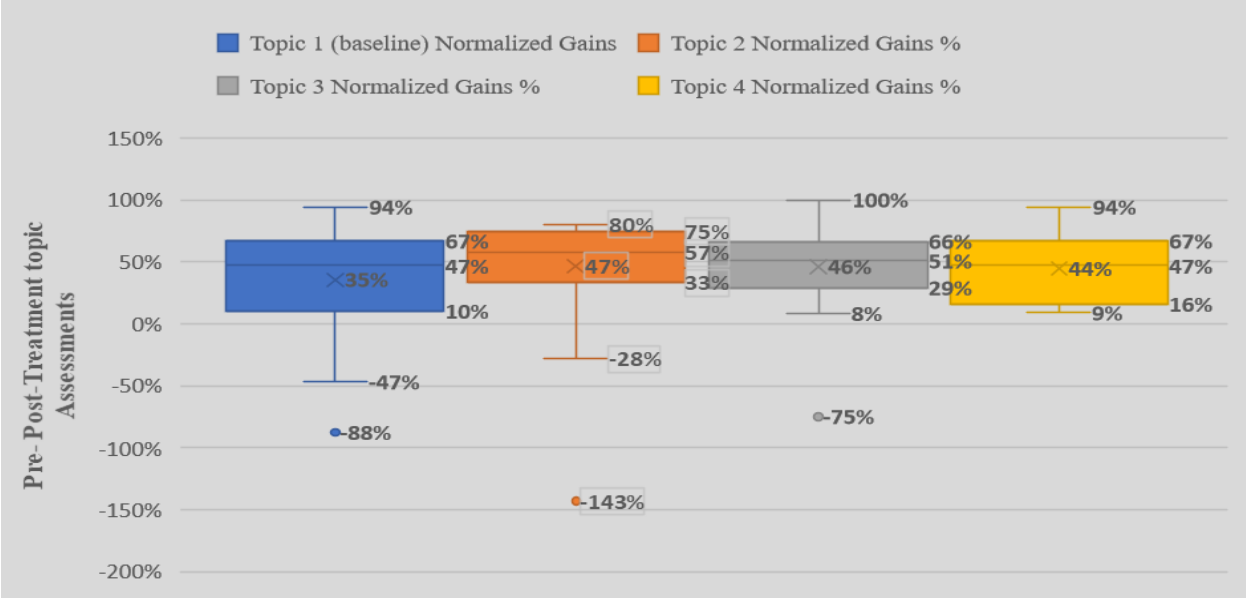


Figure 1. Topic assessments normalized gains distribution, pre vs. post-treatment, (*N*=25).

As seen in Table 1, and confirmed through pre and post- treatment t-test analysis of the topic assessments, there is very little correlation between average student grade percentage and the treatment. However, there is a minor increase in average normalized gains, with a median gain of 11.5% over the course of treatment. Interestingly, sub-group

three, the lowest performing sub-group, experienced the greatest change in normalized gains over the course of the treatment. This group had an average increase of 18% as compared to the three percent and one percent gains of the respective middle to high-performing sub-groups. The change in normalized gains distribution illustrates an improved conceptual understanding between pre and post-treatment. The normalized gains distribution, excluding outliers, decreased significantly over the course of the treatment dropping from 141 percentage points to 85 percentage points by the end of the topic four. This data supports an increase toward mastery, particularly within the lower-performing students in the class.

Figure 2 illustrates changes in student responses over the course of treatment. Graphed responses were chosen because they were shown to have a strong probability of validity via the Wilcoxon's Rank Test.

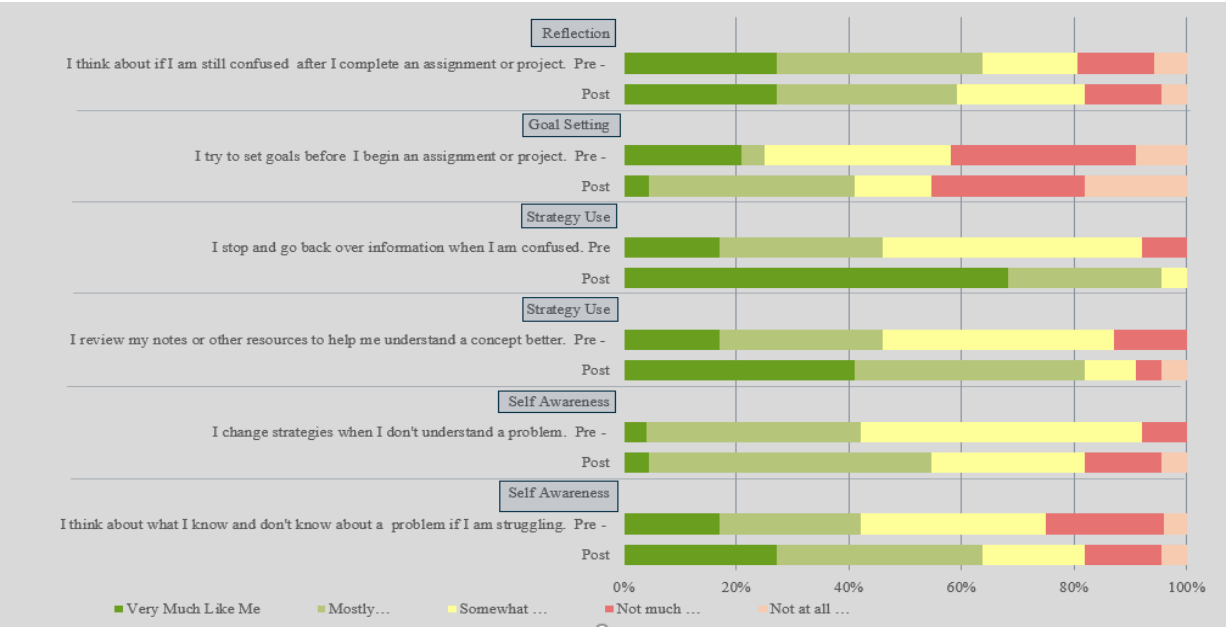


Figure 2. Self-regulated learning assessment survey – pre and post-treatment responses, (*N*=23).

To develop mastery of a concept, students must be able to articulate and understand areas of weakness as well as identify and utilize procedures and strategies for improvement. This is essential to develop independently-driven learning. Post-treatment survey and interview responses indicated an increased ability to identify poor concept understanding and identify resources and strategies to aid them. Figure 2 illustrates pre and post-treatment responses to the SRL survey. Post-treatment responses suggest students had an increased perception of their ability identify and utilize strategies.

There was an 18% increase in students' perception of their own ability to identify areas of weakness. In a student interview, one student, from sub-group three, stated, "It takes extra time, but it has been really helpful to finish the math notes with writing about the things that we know and still don't know. It helps to look back through the notes to see I can figure things out. If I can't figure it out through my notes, I can ask someone else or you." This self-awareness of conceptual understanding and the subsequent analysis of strategy use are the cornerstone of an independently-driven learner.

Figure 3 contains pre- and post-treatment Growth Mindset Confidence Survey responses and illustrates changes in student volition, motivation, and effort over course of the treatment.

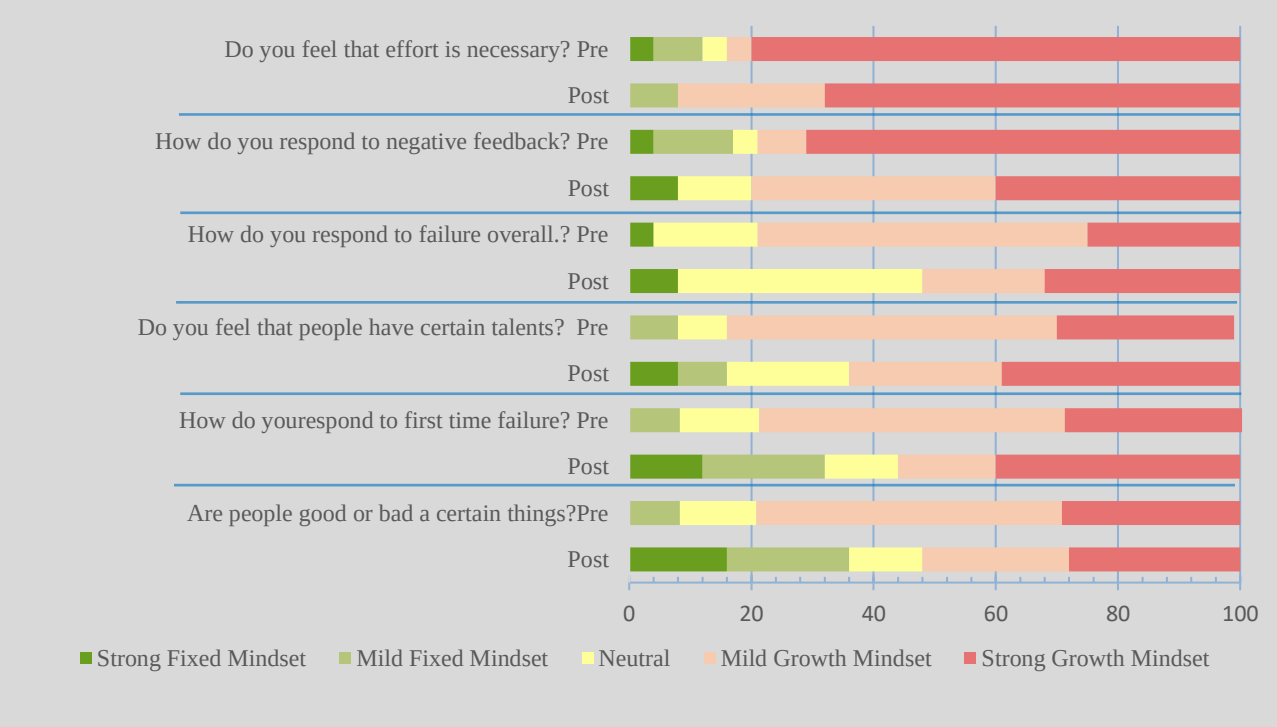


Figure 3. Growth mindset confidence survey pre and post-treatment responses, (N = 25).

Post treatment, students not only felt more confident identifying areas of weakness, but they also changed their mindset in how they perceived themselves in the context of struggle. There was a stronger perception that mistakes and struggle are an essential part of the learning process. There was an 11% increase in students with a strong leaning toward a growth mindset regarding the response to failure upon first trial of a concept. Students began to see that struggle is a natural part of the learning process with no negative intellectual judgement of the individual.

A follow-up open response question queried students about how they feel when they struggle with a concept. What strategies do they use to get themselves "unstuck"? Common responses for students in the lower performing sub-group were to ask for help, "struggle through it", or think about another problem or assignment to help process the current problem. Students in the higher-performing subgroup, have a more difficult time

with struggle; there is an immediate desire to get outside help from someone deemed a higher authority - a teacher or parent. This suggests that this group is more extrinsically driven, particularly when faced with struggle. Additionally, this group lacks opportunities to struggle and expand their strategy repertoire. Whereas, the two lower-performing groups, have encountered more struggle and have to be more resourceful.

Interestingly, very few students acknowledged the feeling part of the open-response and moved directly into how they worked to reframe and re-strategize their approach to the problem. I found this trend in daily interactive notebook entries as well. Students removed the emotional (volition) state from the process.

Post treatment, there was a 36% shift from a strong growth mindset to a mild or neutral growth mindset in the response to a survey question regarding negative feedback. In the pre-treatment survey 71% of students perceived they had a strong growth mindset regarding failure. Post treatment, only 32 % expressed a strong growth mindset; whereas, 24% expressed a mild growth mindset and 40% stated a neutral mindset Even though students expressed a shift in perception away from a strong growth mindset regarding failure, their open-response questions demonstrate a strong growth mindset. In the open-response follow-up question, many students specified that negative feedback is difficult to hear, but they are still willing to take advice as exemplified in the following quotes, “The feedback was kind of hard in a way because I thought I did well, but I can do better next time.” Another said, “The last time I got negative feedback was on my spelling story. My dad told me to make the story longer and use more spelling words. I did what he said, and I got a really good grade.”

Three of the 25 students (12%) consistently identified with a fixed mindset regarding negative feedback. However, I found no correlation between fixed mindset and performance level regarding this question; students who identified with a fixed mindset were part of each sub-group. Their open-response answers indicate that the greatest correlation, is that those with a fixed mindset operate in a volition-driven state based on responses to negative feedback, failure, and risk. Each of the three students identified a strong fixed mindset in response to failure. One student expressed the following sentiment regarding failure, "I feel that there is no hope, and I need a teacher." Another stated that "I didn't care and put the assignment away." The emotional response and desire to turn away from the problem or seek outside guidance prohibits the individual from learning from the feedback or continue to find alternate ways to address the disequilibrium.

This is in juxtaposition to the remaining 88% of the class. In reply to an open-response question concerning how students responded to a bad grade on assignments, one student replied, "I will either correct it or study it so on the next assignment I can do better on it." Another replied, "I look at the assignment and find out what I did wrong, then correct it." Sixty-eight percent of the students had a response that included some iteration of "I saw my misunderstanding understanding of a concept or specific questions." Again, removing the emotional response to feedback and failure is a necessary progression to develop a growth mindset that will allow students to have the confidence and resilience to move through the learning process.

In order to develop necessary skills to be independently- driven learners, students not only need to recognize areas of struggle (self-awareness), but also have strategies to independently progress. There was a 32% increase in students who expressed a strong identification with using notes and other resources as a strategy. One student responded to an open-response prompt, "My notes help me a lot, because I can look back at the lesson." Fifty-six percent of students stated they use their math interactive notebooks (notes) to help themselves when they "get stuck" before or during a lesson. There was a 36% increase in students who identified that they go back over the question and find alternate ways of looking at the problem. One student said, "I use drawing a diagram to help me. They are helpful because I'm a visual learner." Forty percent of the students claimed that they create diagrams or other drawings as a strategy when they are confused. The ability to utilize a variety of strategies allows students to be flexible and approach the problem through numerous angles. Students can find a solution path independent of an external guide through the schema development process; meaning, that they are independently capable of building upon prior knowledge to develop current understanding.

The final sub-questions explored how the development of self-regulation of metacognition helped me to foster a learner-centered classroom. I used two methods to evaluate this question. A third-party observation tool was used to monitor instructional methods and processes that contribute to or prohibit student independence in learning. This was a mixed methods observational tool composed of a frequency of observation, observer reflection of the lesson using guiding questions, and a learner-center classroom rubric that examined the role of the teacher in the classroom. Additionally, I kept a

reflection interactive notebook that helped me to explore three primary questions. What did I do that supported learner independence? What metacognition strategies did I observe students use? What did I do to enable student dependence on me as a teacher?

The third-party observation did not show significant changes between baseline, mid, and post-treatment observations. The Learner-Centered Classroom rubric that assessed two principle categories: role of the teacher and function of concept acquisition, showed very little change between pre and post-treatment observations. The rubric observations recorded a strong leaning towards a learner-centered classroom. The median score for each observation question was three, on a 1-3 scale: one indicates teacher-centered, two indicates transitional, and three indicates learner-centered.

Figure 4 shows average percentage of observed behavior as recorded by the third-party Frequency Observation tool. This figure illustrates observed change in student behavior that indicate a shift toward a learner-centered classroom

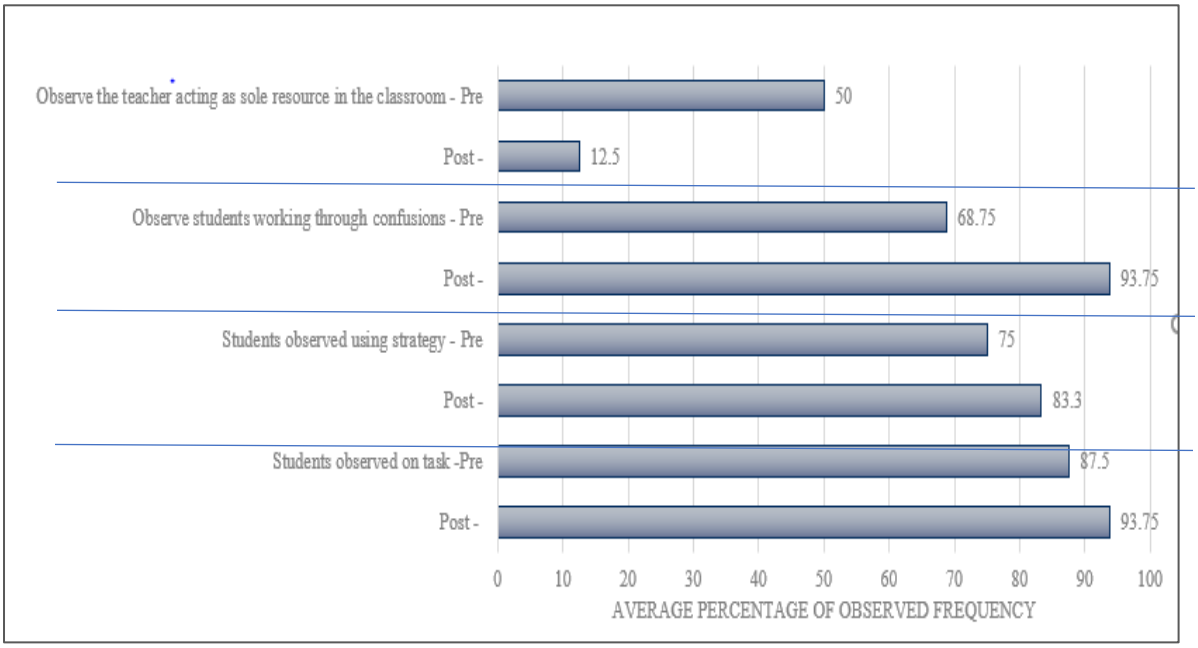


Figure 4 Frequency observation of behavior – pre vs.post-treatment, (N = 25).

The frequency observation tool did provide minimal indication of change pre and post-treatment. There was a 25% increase in instances of students working independently through confusion and a 37.5% decrease in occasions of the teacher being the sole classroom resource. The observer made note of my role as a facilitator and resource to provide constructive feedback, guide questions to elicit a variety of approaches to the students. Students were observed generating questions and examples, solving problems, leading discussions, and addressing questions posed by their peers.

I do expect a high-degree of student participation and ownership in the classroom. However, I feel that the observer didn't adequately used the third-part observation tool, or had a skewed perception of the observation. The observer only noted one occasion in which I answered a question rather than posing the questions to the class. However, looking back at my own journal, I found numerous days where I struggled to articulate a variety of strategies that I used to support learner independence outside of the structure of the math interactive notebooks. I regularly noted times that I enabled student dependence upon me as a teacher. I attempted to evaluate how students process a problem in order to structure my support. When I see that the student is at a significant conflict with his/her existing mental model, I frequently provide guidance to model the problem is a visual way, as this is my comfort zone. This is also why many students responded that they used drawings and diagrams to model problems when they are "stuck". Granted, this is a pedagogically sound process to help move students through the concrete, pictorial, abstract process, but it helped me to realize that I need to diversify my set of strategies.

INTERPRETATIONS AND CONCLUSIONS

Results were statistically insignificant. Even though there was minimal or arguable quantitative evidence of change in student practice and behavior after self-efficacy and self-regulated learning instruction, there were positive results. There is evidence suggesting an improvement in student ability to articulate areas of weakness and utilize strategies to improve academic performance. While average test scores did not increase significantly, there was an improvement in normalized gains, especially in the lower to mid-performing sub-groups. This indicates movement toward content mastery.

Improvements in self-efficacy and use of metacognition processes to independently drive the learning process are a work in progress. Post-treatment growth mindset survey results did not show significant movements towards a growth mindset, and, in some cases, showed movement towards a fixed mindset. Failure and negative feedback continue to have relevance and a negative connotation for the students, but they can work through the negative reaction and move through the learning process (See Figure 3). It will be necessary to continue to work to develop a growth mindset to enable students to have confidence and volitional resilience through the learning process

While students are experiencing growth and confidence in self-awareness, and strategy use; there is still progress that can be made regarding organization and self-reflections/evaluation, particularly within the "evaluation" phase of the self-regulated learning process (See Figure 2). Through open-response and survey questions, I can see that I need to continue to help students with evaluation, reflection, and organization. Students indicated they struggled most with the reflective purpose and process during the

evaluation stage of the self-regulated learning cycle. I need to do further work to help them see the value of feedback into future learning, not just for the immediate learning context. It is also clear that I need to continue to work with students to organize information and pace the learning process.

VALUE

Fostering a learning-centered classroom is my goal. It is necessary to continue to provide the scaffolding and opportunities so students can become more adept with the self-regulated learning process and familiar with metacognition skills needed to drive their own learning.

Students who can take ownership of their learning continuum through self-regulation and are successfully able to manage negative emotions related to struggle and failure are more apt to take more academic risks and have the resilience and perseverance to set and achieve high goals for themselves.

There was minimal or arguable quantitative evidence of change in student practice and behavior after self-efficacy and self-regulated learning instruction, but there is qualitative and anecdotal value. Any move towards self-regulations by students indicates they feel they are acquiring more skills and confidence to drive specific components of their learning process. I will continue to use confidence surveys to help me structure scaffolding needs of my students and empower them to become independent and intrinsically-driven learners. Specifically, I will continue to provide scaffolding and opportunities to develop organization and self-reflection skills. As I refine my program, I hope to see improved confidence in my students to drive their own learning.

I look forward to continuing my work to develop a learner-centered classroom by nurturing capable and confident independent learners who can drive their own learning process. This is just as much a work in progress for me as it is for my students. In both cases, awareness is the greatest driver of change.

REFERENCES CITED

Bandura, A, Martinez-Ponz, M, &Zimmerman, B, (1992), Self-Motivation for Academic Attainment: The Role of Self-Efficacy Beliefs and Personal Goal Setting, *American Educational Research Interactive notebook*, 29, 663-676.

Berthold, K, Nuckles, M., & Renkl, A. (2007) Do Learning Protocols Support Learning Strategies and Outcomes? The Role of Cognitive and Metacognitive Prompts, *Learning and Instruction,* 17, 564-577.

Briceno, E., (2017), Growing Lifelong Learners. Retrieved from https://www.mindsetworks.com

Brock, A, Hundley, H, (2017) *The Growth Mindset Coach: A Teacher's Month-by-Month Handbook for Empowering Students to Achieve*, Berkley, CA: Ulysses Press

DeCastella, K, & Byrne, D, (2015)My Intelligence May be More Malleable than Yours: The Revised Implicit Theories of Intelligence (Self-Theory) Scale is a Better Predictor of Achievement, Motivation, and Student Disengagement, online interactive notebook.

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

Glogger, I & Schwonke, R., (2012), Learning Strategies Assessed by Interactive notebook Writing: Prediction of Learning Outcomes by Quantity, Quality, and Combinations 468.

Hiemstra of Learning Strategies, *Interactive notebook of Educational Psychology,* 104 452-, D., Timmerman, M., & Van Yperen, N., (2018), Student Effort Allocation to Their Perceived Strengths and Weaknesses: The Moderating Effect of Instructional Strategy, *Learning and Instruction.*

Hadwin, A & Winne, P., (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *The educational psychology series. Metacognition in educational theory and practice* (pp. 277-304). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Mega, C., Ranconi, L & De Beni, R., (2014), What Makes a Good Student? How Emotions, Self-Regulated Learning, and Motivation Contribute to Academic Achievement, *Interactive Notebook of Educational Psychology, 100*, 121-131.

Ng, B., (2017), The Neuroscience of Growth Mindset and Intrinsic Motivation, *Brain Science,* 8, 8-18.

Pandero, E. & Alanso-Tapis, J., (2014), How do students self-regulate? Review of Zimmerman's cyclical model of self-regulated learning. *Anales de Psicologia, 30,* 450-462.

Pintrich, P, (2002) The Role of Metacognitive Knowledge in Learning, Teaching, and Assessment, *Theory Into Practice,* 41, 219-225.

Seaton, F., (2018), Empowering teachers to implement a growth mindset, *Educational Psychology in Practice,* 34, 42-57.

Sufen, C., Chih-Chi, H., & Te-Lien, C., (2016), The Effects of Metacognitive Scaffolds on Low Achievers' Laboratory Learning, *International Interactive notebook of Science and Math Education, 14,* 281-296.

Zapeda, C., Richey, J. E., Ronevich, P., & Nokes-Malach, T., (2015), Direct Instruction of Metacognition Benefits Adolescent Science Learning, Transfer, and Motivation: An In Vivo Study, *Interactive notebook of Education Psychology, 107,* 954-970.

Zimmerman, B, (2008), Investigating Self-Regulation and Motivation: Historical Background, Methodological Developments, and Future Prospects, *American Education Research Interactive notebook,* 45, 166-183.

APPENDICES

APPENDIX A

IRB EXEMPTION

INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects
FWA 00000165

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MEMORANDUM

TO: Karin **'Camille'** Larsen and Water Woolbaugh

FROM: Mark Quinn Mark Quinn CMJ
Chair, Institutional Review Board for the Protection of Human Subjects

DATE: October 17, 2018

RE: *"The Effects of Systematic Direct Instruction of Metacognitive Skills Through Self-Regulated Learning and Self-Efficacy Development" [KCL101718-EX]*

The above research, described in your submission of October 14, 2018, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

_X_ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

_X_ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

_____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX B

DATA COLLECTION MATRIX

	DATA COLLECTION METHODOLOGIES							
DATA COLLECTION MATRIX	SELF-CONFIDENCE SURVEY – GROWTH MINDSET	SELF-CONFIDENCE SURVEY SELF-REGULATED LEARNING	INTERVIEW	PRE-TEST/POST-TEST – CONTENT AREA	INTERACTIVE NOTEBOOK ENTRIES	OBSERVATIONS	TEACHER INTERACTIVE NOTEBOOK	THIRD-PARTY EVALUATION TOOL
RESEARCH QUESTIONS								
Main Topic How does the systematic and direct instruction of self-efficacy (growth mindset development) and self-regulated learning (metacognition) skills impact student self-sufficiency, self-confidence, and intrinsically driven academic growth	2,3	2,3	1	3,4,5	1,5	1,5	1,5	1,5
Sub-question #1 How does the treatment impact the student's ability to articulate areas of confusion or weakness as well as identify and utilize strategies to address identified area of weakness influence academic performance and content mastery?	1,2,3		1,5	1,2,3,5	1	1,5	1,5	5
Sub-question #2 How does the treatment impact self-efficacy and metacognition? If so, how does self-confidence impact the ability to independently drive learning?	1,2,3,5		1,2,3	1,5	1,2,3,5	1	2,3	1,5
Sub-question #3 How does the treatment impact my ability to foster a learner-centered classroom where students direct and manage their own learning?	1,2,3,5			1,5	1,2,3,5	1	2,3	1,5

Key – reasoning for data collection tool

1) Qualitative data for student perspective on individual growth and perspective of methods.
2) Quantitative data regarding student growth over the course of treatment regarding metacognition and self-efficacy
3) Quantitative baseline data
4) Quantitative data regarding student content-knowledge growth over the course of treatment
5) Qualitative and Quantitative data regarding effectiveness of teacher-generated criteria correlated against student mastery

APPENDIX C

GROWTH MINDSET CONFIDENCE SURVEY

PRE-, MID-, AND POST-TREATMENT

Growth Mindset Confidence Survey

* Required

1. **What is your last name?** *

2. **Do you believe that you are either good or bad at doing things (examples: running, basketball, reading, math, writing...)?** *
   Mark only one oval.
   - 1. Yes! people are either good or bad at certain things.
   - 2. There are things that I know that I am really good at and really bad at. I can get a little better if I try.
   - 3. Sometimes, but not all the time.
   - 4. Somethings are easier than others, but I suppose that I can get better if I practice
   - 5. I can get better with anything that I want if I practice and work hard.

3. **Do you feel that people have specific talents that they are born with?** *
   Mark only one oval.
   - 1. Yes! You either good or bad at certain things.
   - 2. There are things that I know that I am really good at and really bad at. I can get a little better if I try.
   - 3. Sometimes, but not all the time.
   - 4. Somethings are easier than others, but I suppose that I can get better if I practice
   - 5. I can get better with anything that I want if I practice and work hard.

4. **How do you feel when you try something for the first time and you don't succeed?**
   Mark only one oval.
   - 1. I really don't want to do it ever again because I will never get it right - it is something that I just can't do.
   - 2. I really don't want to do it ever again, but I will if I am forced. There is a small chance that I can get better.
   - 3. I don't want to do it again, but I can probably get better over time if I work at it.
   - 4. I probably will get better with time and practice. It won't always be easy, but I can get better.
   - 5. I can totally get better with time a practice. It is rare to get things right on the first try.

5. **Tell me how you feel when you are stuck on an assignment. What do you do to get yourself "unstuck"?** *

5. **If you fail at something, how do you feel.** *
Mark only one oval.

- 1. I am embarrassed and I will never do it again because people will laugh at me.
- 2. I am embarrassed, but I MAY try it again
- 3. I might be a kind of embarrassed, but I can get better next time.
- 4. I wish that I got it right the first time, but I can get better next time.
- 5. Oh well, sometimes that happens, I can do better next time.

6. **How do you respond to negative feedback?** *
Mark only one oval.

- 1. Oh boy, I really stink at this. I guess that I really can't do any better - no use trying again.
- 2. I suppose that I see what I need to do differently, but it is too much effort to try to do it again. It might not change anything if I do.
- 3. I guess that there are somethings that I need to do better, but I don't want to try again because this is so difficult for me.
- 4. I guess that there are somethings that I need to do better. It might be worth it to try again.
- 5. Oh, I see what I need to do differently next time. I appreciate that I now know what I did wrong so that I can get better next time.

7. **How do you feel about effort?**
Mark only one oval.

- 1. Why do I need to put forth effort - I am either good or bad at things. Effort won't change any thing.
- 2. Occasionally I put in effort if it is something that I enjoy doing. If it is something I don't like, then there is no use doing it.
- 3. I don't want to put forth effort because things are just to difficult, but I may try if I have to.
- 4. I sometimes get frustrated when I have to work hard at somethings. There are times I don't bother trying unless my parents or teacher make me.
- 5. It can take time and effort to learn new things. Somethings are easier for me, but some things require more effort.

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APPENDIX D

SELF-REGULATED LEARNING SURVEY

PRE-, MID-, AND POST-TREATMENT

SRL Assessment: Metacognition

* Required

1. **Email address** *

2. **What is your Last Name** *

Self-Awareness

3. **I know my academic strengths and weakness.** *
Mark only one oval.
- Very much like me
- Mostly like me
- Somewhat Like Me
- Not much like me
- Not much like me at all

4. **I slow down I encounter important information** *
Mark only one oval.
- Very much like me
- Mostly like me
- Somewhat Like Me
- Not much like me
- Not much like me at all

5. **I change strategies when I don't understand a problem.**
Mark only one oval.
- Very much like me
- Mostly like me
- Somewhat Like Me
- Not much like me
- Not much like me at all

6. **I think about whether I understand something or not. I understand if I am "getting it" or if I am confused.** *
Mark only one oval.

- Very much like me
- Mostly like me
- Somewhat Like Me
- Not much like me
- Not much like me at all

7. **I think about what I know and don't know about a problem if I am struggling.** *
Mark only one oval.

- Very much like me
- Mostly like me
- Somewhat Like Me
- Not much like me
- Not much like me at all

Strategies

8. **I ask others for help when I don't understand something.** *
Mark only one oval.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like
- Not like me at all

9. **I stop and go back over information when I am confused.** *
Mark only one oval.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like
- Not like me at all

10. **I draw pictures or diagrams to help me understand while learning** *
Mark only one oval.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like
- Not like me at all

11. **I put information into my own words to help me understand better.** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

12. **I think about several ways to solve a problem and choose the best one for me.** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

13. **I review my notes or other resources to help me understand a concept better.** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

14. **In the last two weeks, which strategies did you use? Which are the most helpful to you and why?**

_____

15. **What resource do you use most often when you are stuck? Why is it to most helpful?**

_____

Goal Setting and Planning

16. **I think about what I really need to learn before I begin a task.** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

17. **I try to set goals before I begin an assignment or project.** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

18. **I ask myself question before I begin working on a challenging problem or assignment.** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

19. **I read instructions carefully before I begin a task.** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

20. **Which part of the planning process is more helpful to you: asking questions (what is known and unknown), creating goals, reading the evaluation criteria, identifying what I need to do, identifying resources, and/or organizing my time? Why do you feel it is more important?**

_____

21. **Which part of the planning process do you struggle with the most? Do you think that it is important to address that area? Why**

_____

Organization

22. **I feel like I organize my time well to complete an assignment or project.** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

23. **I pace myself when completing an assignment or project** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

24. **I am good at organizing information.** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

Self-Reflection and Evaluation

25. **I think about several possible answers before completing my final answer** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

26. **I know how well I did after I finish an assignment or test.** *
Mark only one oval.

- ◯ Very much like me
- ◯ Mostly like me
- ◯ Somewhat like me
- ◯ Not much like
- ◯ Not like me at all

27. **I think about what I have learned after I have completed an assignment.** *

Mark only one oval.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like
- Not like me at all

28. **I think about if I am still confused about something even after I complete an assignment or project.** *

Mark only one oval.

- Very much like me
- Mostly like me
- Somewhat like me
- Not much like
- Not like me at all

29. **Think about your last lab assignment. Did you have an idea of how well you did before you knew your grade? Based on the feedback that you received do you understand what you did well and what you need to work on in the future? Give an example.**

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APPENDIX E

THIRD-PARTY OBSERVATIONAL TOOL

Date:

Time:

Class Observed:

Observer:

Part I – Frequency Observation:

Please indicate the percentage of occurrence that you observed the following scenarios (25%, 50%, 75%, and 100%). If the class task does not relate to the purpose of the observation goal, use N/A

	0-10 min.	10-20 min.	20-30 min.	30-40 min.
1. Students are observed on task.				
2. Student is observed disengaged. (-)				
3. Student observed using strategy.				
4. Student expressed confusion. (-)				
5. Observe student working through confusion				
6. Observe the teacher acting as the sole resource in the classroom. (-)				

Part II – Observational Notes:

Please answer the following questions based on your observations.

1. What topic was covered during the observed lesson? Provide a brief synopsis of the lesson.

2. What teaching strategies did the teacher use in the lesson?

3. What level of student engagement did you observe in the lesson (high, medium, low). Please use examples to illustrate choice.

4. Were students able to articulate expected outcomes? Provide example(s).

5. Did student conversations within the partner activity and in whole-class discussion follow the expectations of the lesson? Were students able to use the vocabulary and implement strategies discussed as a class? Provide examples.

6. Did the teacher facilitation of the lesson confuse or guide the students to develop an understanding of the lesson concept?

7. What could the teacher do to improve the lesson?

Part III –Rubric:

https://cetl.kennesaw.edu/learner-centered-rubric-classroom-observations

#1: The role of the teacher (The teacher is not a conveyor of information; the teacher is a facilitator. It's the students who do the hard messy work of learning; they are not passive recipients of knowledge.)			
Learner Centered (3)	**Transitional (2)**	**Teacher Centered (1)**	**Comments**
For the majority of the class session, the teacher acts as a resource person (giving constructive feedback, eliciting different approaches, encouraging repeated attempts, etc.), working to support and enhance student investigations.	1. Occasionally during the class session, the teacher acts as a resource person, working to support and enhance student investigations.	1. The teacher does not act as a resource person during class, working to support and enhance student investigations.	
The teacher expects students to generate examples, review material, solve problems, lead discussions, critically analyze information, etc.	There are opportunities for the students to generate examples, review material, solve problems, etc., but these opportunities are limited or the purpose of the activities is not clearly connected to course material.	The class session consists predominantly of the teacher conveying information; students watch while the teacher works.	
Questions are welcomed by the teacher, and the teacher makes an effort to redirect to the rest of the class so that other students answer questions rather than the teacher.	Questions are welcomed by the teacher, but questions are mostly answered by the teacher rather than other students.	Questions from students may be entertained to a limited degree.	
The teacher ensures that the tasks students do in class are challenging.	The teacher ensures that the tasks students do in class are moderately challenging.	The teacher doesn't provide any opportunities for students to engage in challenging tasks. Alternately, the tasks that are provided are not challenging.	

#2: The function of content (Instead of "covering" the material, the students develop learning skills and learn how to think like those in the discipline.)			
Learner Centered (3)	**Transitional (2)**	**Teacher Centered (1)**	**Comments**
There is evidence that the teacher helps students to be independent and self-directed learners.	There is some evidence that the teacher helps students to be independent and self-directed learners	There is no evidence that the teacher students to be independent and self-directed learners	
The tasks that students do in class seem to reinforce skill development.	Some of the tasks that students do in class reinforce skill development.	The students do no tasks in class that reinforce skill development; the teacher is primary covering content	
Content is utilized in such a way to provide opportunities for students be independent thinkers.	Content is utilized in such a way to provide some opportunity for students to be independent thinkers.	Content is not utilized in such a way as to help students be independent thinkers.	

APPENDIX F

STUDENT INTERVIEW QUESTIONS

Student Interview Questions

Participation in this interview is voluntary and participation or non-participation will not affect a student's grade or class standing in any way.

1. Do you feel that the work that we have been doing on self-regulated learning has been helpful? Why or why not?
2. Which areas of self-regulated learning do you feel most comfortable: self-awareness, strategy identification and use, goal setting/planning, organization, or self-reflection? Why?
3. Which areas of self-regulated learning do you feel least comfortable: self-awareness, strategy identification and use, goal setting/planning, organization, or self-reflection? Why?
4. Do you think that you will continue to use these strategies in the future? Why?
5. How have these strategies helped you as a student?
6. Do you feel that the work that we have been doing on growth mindset has been helpful? Why or why not?
7. Do you feel you react differently to struggles and feedback differently?
8. Has the reflective work that we have been doing helped you. If so, how? If not, why?

APPENDIX G

ADMINISTRATOR EXEMPTION FORM

Administrator Exemption Regarding Informed Consent

I, Amy Piazzola, Principal of Cayuse Prairie, verify that the classroom research conducted by Camille Larsen is in accordance with established or commonly accepted educational settings involving normal educational practices and that I approve the project. To maintain the established culture of our school and not cause disruption to our school climate, I have granted an exemption to Camille Larsen regarding informed consent.

Amy Piazzola Superintendent/Principal
(Signed Name, Title of Position)

Amy Piazzola
(Printed Name)

10-12-2018
(Date)

Administrator Approval

I, Amy Piazzola, Principal of Cayuse Prairie, verify that I approve of the classroom research conducted by Camille Larsen.

Amy Piazzola Superintendent/Principal
(Signed Name, Title of Position)

Amy Piazzola
(Printed Name)

10-12-2018
(Date)