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# Self-Regulated Learning and Mathematics Achievement in a Fourth Grade Classroom

**Abstract**

This research examines the relationship between self-regulated learning and mathematics achievement. The sample included 10 students enrolled in fourth grade at a small, private elementary school in the Midwest. During the third quarter of the school year, students were taught methods of learning mathematics through self-regulation. The grades were recorded before the implementation at the conclusion of the second quarter and again at the conclusion of the third quarter once self-regulation was implemented. A t-test was used to compare the mathematics scores. There was no significant difference between the second and third quarter mathematics grades. This is an important result as it differed from the findings in research.

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by

Dawn Eliserio

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Submitted in Partial Fulfillment  
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Self-Regulated Learning and Mathematics Achievement in a Fourth Grade Classroom

by

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### **Abstract**

This research examines the relationship between self-regulated learning and mathematics achievement. The sample included 10 students enrolled in fourth grade at a small, private elementary school in the Midwest. During the third quarter of the school year, students were taught methods of learning mathematics through self-regulation. The grades were recorded before the implementation at the conclusion of the second quarter and again at the conclusion of the third quarter once self-regulation was implemented. A t-test was used to compare the mathematics scores. There was no significant difference between the second and third quarter mathematics grades. This is an important result as it differed from the findings in research.

Effective learners maintain many of the same traits. Recent literature has identified these traits as interest, curiosity, taking initiative, high levels of activation, autonomous work, persistence in the face of difficulties, and maintaining self-motivation toward the task at hand (Kuyper, van der Werf, & Lubbers, 2000). Furthermore, Zimmerman (1989) and Perry and VandeKamp (2000) have identified the described criterion which challenges students to take an active role in their personal learning environment and in ownership of their learning, as self-regulated learning. Self-regulated learning (SRL) is defined as a multi-dimensional process involving personal (cognitive and emotional), contextual, and behavioral components (Zimmerman, 1989). Self-regulated learning is viewed as proactive processes that students use to acquire academic skills, such as setting goals, selecting and deploying strategies, and self-monitoring one's effectiveness. This is in contrast to a more common reactive event that happens to students due to impersonal forces (Zimmerman, 2008).

Teachers who use methods that incorporate self-regulated learning have found that the students are more responsible for the learning in the classroom setting (Middleton & Patrick, 2002). Self-regulated learning instruction can occur in many subject areas. However, according to Metallidou and Vlachou (2007) mathematics is still perceived as a threatening area; one that requires the application of cognitive strategies. The teaching of self-regulatory skills must be instilled in the students to encourage the application of productive study skills and to build ones' self-efficacy in the area of math.

If students in mathematics are going to become self-regulated learners, they need to be presented opportunities that allow them to reveal their thinking and to observe the thinking of others. While conclusive evidence has not been presented to demonstrate that self-regulated learners have overall higher achievement than non-self-regulated learners, Stoeger and Ziegler

(2008) show a growth rate in homework scores and quizzes in self-regulated learners that exceeded the average. The purpose of this study is to discover the relationship between a self-regulated learning environment and achievement levels in mathematics.

### **Research Question**

Does a self-regulated learning environment increase the achievement in math in fourth grade?

### **Definitions**

The researcher provides these definitions unless otherwise noted.

**Goal Setting** – involves establishing measurable objectives.

**Learning Time** – the amount of time a student spends working on relevant academic tasks while performing those tasks with a high rate of success (Boekaerts, 1997).

**Learning Strategy** – the methods used to teach students new material.

**Metacognition** – to think about one's thinking.

**Methodologies** – the teaching methods and practices used in a classroom setting to enhance student learning.

**Self-Efficacy** – a student's belief about what they are capable of achieving.

**Self-Regulated Learning** – the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning process (Cleary & Zimmerman, 2004).

**Self-Regulated Learners** – students become aware of their own learning processes.

**Self-Regulated Learning Environment** – atmosphere in which participants are engaged in their own learning process.

**Strategic Planning** – a continuous process where students make decisions about intended future outcomes.

### **Literature Review**

Self-regulated learning is a term that dates back to the 1970's and 1980's. Researchers came together at a symposium at the American Educational Research Association in 1986 and defined self-regulated learning as “the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning process” (Zimmerman, 2008, p.167). Cleary and Zimmerman (2004) stated that self-regulation involves learners who proactively direct their behavior or strategies to achieve self-set goals. These students also rely on feedback to modify or adjust their strategies and behaviors when unable to initially attain their goals (Zimmerman, 1989). This demonstrates the student involvement in the learning process as they are called to be proactive participants.

Self-regulation is separated into three phases: a pre-action phase, an action phase, and post-action phase. The pre-action phase focuses on goal setting. In this phase, students set individual goals. During this initial phase, the students and teacher also strategically plan the course of study to reach the desired outcome. This phase involves many motivation factors such as self-efficacy beliefs, outcome expectations, task interest or value to the student, and goal orientation. The action phase includes the amount of learning time, attention focusing, self-

instruction, and the application of task strategies utilized to achieve desired outcomes. (Pintrich, Smith, Garcia, & McKeachie, 1991). This action phase encourages the student to use self-control and be observant in the learning process. After the action phase is complete, the post-action phase begins. In this phase, the learner evaluates the result of his or her efforts and draws conclusions for further learning processes (Perels, Dignath, & Schmitz, 2009). After the learning has been evaluated, the student can then react to the results. The model is shown in Figure 1.

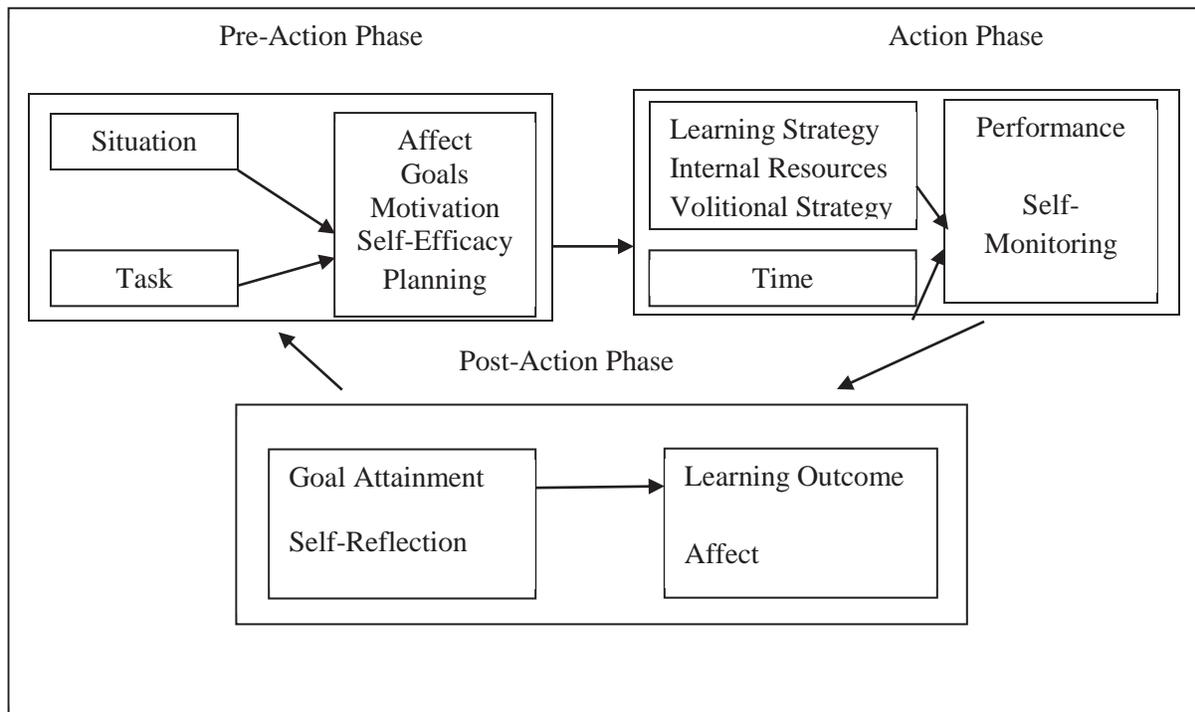


Figure 1. Process model of self-regulation (Schmitz & Wiese, 2006)

The interest and research done in self-regulated learning has developed because of developments in theoretical paradigms and methodologies (Boekaerts, Pintrich, & Zeidner, 2000; Zimmerman & Schunk, 1989, 1991). In other words, teaching methods have changed over time and therefore require the teacher to adapt the teaching style to meet the needs of the student. In addition, Pressley and McCormick (1995) found that the interest in self-regulated learning is due

to a lack of applying study skills while working at home. Furthermore, Boekaerts (1997) noted that the self-regulatory skills are vital, not only to guide one's learning during schooling, but also to educate oneself and update one's knowledge after leaving school. When students leave their formal schooling, the skills taught in self-regulated learning environments should provide them with the framework necessary for life-long learning.

There are a number of teaching methods that would aid students in becoming accountable for their work. Recent research promotes multiple- strategy instruction where students are taught how to use and coordinate multiple strategies (Gersten, Fuchs, Williams, & Baker, 2001; Neufeld, 2005). Lombaerts, Engels, and van Braak (2009) narrowed these multiple strategies into six key components desired in teaching that would promote pupils' self-regulation.

The first component is to motivate the pupils to actively participate in the teacher-learning processes (Boekaerts, 1997). Some ways in which a teacher can incorporate lessons that encourage students to be active participants include, but are not limited to, reciprocal teaching, cooperative learning, hands-on strategies, and paying attention to learning styles.

Pilonieta and Medina (2009) noted that there are three key elements in effective comprehension strategies. These elements include explicit instruction of strategies through declarative, procedural, and conditional knowledge, the release of responsibility from the teacher to the student, and the use of multiple strategies from the student. Through these strategies, students will gain the ownership necessary to become self-regulated in their learning. This then provides an opportunity for the students to participate in the classroom learning. As teachers continually encourage students to be active participants, the students will become motivated to learn, which establishes the basis for self-regulation.

The second component desired in teaching to promote self-regulation is being able to engage pupils in complex, open-ended activities and offer choices and opportunities to challenge the students (Perry & Drummond, 2002, Perry & VandeKamp, 2000). The choices offered should include what they are doing, whom they are doing it with, where the learning is taking place, and when it is done. By creating room for these choices in the lessons, students may sense an ownership in the learning process. These choices will also allow the teacher to evaluate how each student learns best. The learning environment will be non-threatening because of the open-ended activities offered.

Learning centers are a good example of complex, open-ended activities with the opportunity for choice from the students. In learning centers, students attend various stations which the teacher has spent time developing to encourage specific skills. However, the students can do this work using their own pacing, with others in their groups or individually, and in various areas in the classroom. During their independent work time, the teacher meets with small groups of students to encourage them in specific skills. While the teacher meets with the students, he/she should encourage questioning and provide constructive criticism to guide the learning. Learning centers are typically used to develop literacy, although is not exclusive in this area. Wharton-McDonald, Pressley, Rankin, Mistretta, Yokoi, and Ettenberger (1997) commented that one of the most striking features of high-SRL environments is the “sheer density” of the task and instruction students experience in them. The teachers in a self-regulated environment are integrating multiple goals of learning into single lessons, which is clearly evident in centers or in other open-ended activities that challenge each student individually.

The third component in teaching effective self-regulation would be providing support for self-regulated learning by teaching the strategies and skills that are necessary for independent

work (Butler, 2002; Ley & Young, 2001; Perry et. al., 2004; Perry & VandeKamp, 2000). Teachers can incorporate this support through the lessons and through peer collaboration. Self-regulated learning environments encourage choices, constructive criticism, guidance in the learning activities, and ownership of the learning. The strategies must be taught well so students can use these skills in other areas of study. During instruction time in lessons, students will have questions and need clarity. A self-regulated classroom environment is open and collaborative. Therefore, students may need additional help and guidance. Adaptive help seeking is an effective strategy for students who are coping with challenge and students in cooperative learning environments are more likely to ask for help than those in competitive or comparative environments (Newman, 2003). As students work through their learning goals and tasks, the skills that have been incorporated can guide their learning.

The fourth component is providing pupils with opportunities for self-monitoring (Butler, 2002; Butler & Winne, 1995; Zimmerman, 1997), by helping them use and interpret feedback correctly to assess the set goals and by emphasizing short-term, realistic, and specific goals that can easily monitor any progress or improvement (Butler & Winne, 1995; Ley & Young, 2001; Montalvo & Torres, 2004).

Winne and Perry (2000) distinguished between two measuring processes in self-regulation of learning. The first process is using instruments that measure self-regulated learning as an aptitude, which describes relatively stable attributes of the student and allows for predictions of future behaviors. The second process is to use instruments that measure self-regulated learning as an activity or event which is a more complex measurement that collects information on the processes the student goes through while he or she is self-regulating. To measure a student's aptitude, instruments used include self-reporting questionnaires, structured

interviews, and teacher judgments. To measure the activity or event, instruments include think-aloud protocols, methods of error detection in tasks, and observation measures. These processes are a formal approach to monitoring the student and the learning environment. Self-monitoring is important as it allows the students to learn the strategy effectively. The student has to oversee his or her application, his or her effectiveness, and how to change or modify the strategy in case it is ineffective (Montalvo & Torres, 2004). Butler and Winne (1995) stated that monitoring is the cognitive process that assesses the states of progress relative to goals and generates feedback that can guide further action. Monitoring depends on two critical self-regulating components: feedback and goal setting (Butler & Winne, 1995). The feedback provided can guide students toward more productive engagement in learning activities.

The fifth component of teaching effective self-regulation is using evaluation practices that are not threatening to encourage pupils to focus on personal progress and learn from the mistakes made (Ley & Young, 2001; Perry & Drummond, 2002; Perry & VandeKamp, 2000). Monitoring may lead to self-evaluation (Ley & Young, 2001). A teacher can guide students through tasks, give constructive feedback and provide ideas of how to solve the problem. These steps can be helpful to students as they try to become self-regulated learners (Pintrich, 1995). The evaluation done in a classroom should lead students to become more self-regulated. Self-regulation “requires the development of both self-monitoring and self-evaluation processes.” (McCombs, 1989, p. 72). Evaluation practices that are non-threatening include the students reviewing assignments, offering corrective feedback, providing quality control checklists, and comparing their work with a set of standards (Ley & Young, 2001). This is a pivotal point for the individual student. The way in which students accept the feedback or the evaluation process will affect their motivation to be involved in the self-regulating process. This component is part

of the post-action phase of self-regulation. Once the learner evaluates the result of his or her effort on the given assignment, he or she can draw conclusions for further learning processes (Perels, Dignath, & Schmitz, 2009).

The sixth and final component is to emphasize self-reflection and provide support for newly acquired instruction (Paris & Paris, 2001). Patrick and Middleton (2002) found that educators must actively address students' views of knowledge and learning. They recognized that educators cannot assume that students can automatically integrate and revise new and existing information. Therefore, the instruction needs to continually be revised, renewed, and reinforced.

### **Summary**

Research studies have determined the importance of teaching self-regulatory skills to the students. There are very few studies that show that self-regulation does not improve a student's performance. Much of the research included important factors on a student's ability in becoming a self-regulated learner. The factors include motivation, amount of support from home, overall academic achievement, and one's self-efficacy. A question that this study will investigate is if there is an increase in the achievement levels of mathematics in a fourth grade classroom once the necessary skills have been taught to the students. This question will be answered after assessing students prior and post instruction of self-regulation skills.

The purpose of this research project is to examine a learning strategy to encourage a deepened understanding of students' ability to monitor his or her progress through regulating their learning, using the necessary tools developed within a classroom setting. Today, students are facing new demands on their learning because of the increasing knowledge and the desire to

become lifelong learners. Therefore, it is imperative for students to self-regulate their learning, not only in mathematics, but in all areas of education.

## **Methods**

### **Participants**

The participants in this study were the fourth grade students in a small private school in the Midwest. The participant make-up was from a largely homogenous population in terms of age, ethnicity, and background. The students were generally middle class fourth graders in a rural setting. For the 2010-2011 school year, ten students were participants in this study.

### **Research Design**

The intervention was performed after first identifying the students' background knowledge in math. After teaching math without self-regulation, the results were observed and recorded. Following this time period, the lessons were structured specifically to teach with the methods included in a self-regulated learning environment. There was a time of 15 minutes to introduce the self-regulated strategy followed by application of this strategy throughout the lesson. The strategy was then reviewed and practiced throughout the remainder of the quarter in which the study was being conducted. The study was conducted on the entire class after receiving parental approval.

### **Materials**

The materials necessary to carry out the intervention consisted of activities for students to regulate their learning. Lesson plans were created by the experimenter. They consisted of a review of the concepts, self-regulated procedures, and checking for understanding. Lessons

lasted 30 minutes and a time allowance of 15 minutes was given for students to practice their newly acquired skills. See sample lesson plans in Appendix A.

A teacher-created questionnaire was created to check students' self-efficacy and understanding of new material. The questionnaire provided feedback to the experimenter and allowed guidance of the remaining lessons. See questionnaire in Appendix B.

Student scores from quarters 2 and 3 provided feedback for the self-regulation process. The scores displayed the knowledge gained throughout the trial period. These scores are recorded in table one.

### **Procedure**

The design of the research was a correlational study as the relationship between achievement in mathematics and self-regulated learning environment were being studied. A letter was sent to the parents of the students in the class (Appendix C). The independent variable was the self-regulated learning environment. The dependent variable was the achievement level in mathematics.

To conduct this study, the researcher began the school year without implementing the self-regulated learning strategies. The time spent in mathematics was taught using teaching techniques familiar to the teacher and students. The students' ability level and understanding of mathematics was recorded. Then the researcher taught mini-lessons on how students can become self-regulated. These lessons included the students setting personal goals, motivating students, offering challenges, recording personal progress, and self-reflection at the conclusion of the months spent incorporating self-regulated learning into the classroom (See samples of lessons in Appendix A).

Following these mini-lessons and implementation of self-regulation, the researcher looked at the mathematical achievement from the first units in which there was no self-regulation taught, and compared the results with those found in the later units in which self-regulation was taught and practiced. The researcher hoped to find that there was a direct relationship between self-regulated instruction and higher achievement in mathematics.

## **Results**

### **Data Analysis**

A paired samples t-test was used to compare the second quarter and third quarter grades. A 2-tailed t-test was used to show significant differences between pre-self-regulated learning and post-self-regulated learning scores. An alpha level of  $p < .05$  was used to show significance. Any probability less than .05 suggested that the likelihood of that outcome randomly happening would occur less than 5% of the time. Thus, for results less than .05 we rejected the null hypothesis and accepted that the intervention has had an effect on the results.

### **Findings**

The mean 2<sup>nd</sup> quarter scores and 3<sup>rd</sup> quarter scores for each student are recorded in Table 1. The total average for the 2<sup>nd</sup> quarter score was 89.24 and the 3<sup>rd</sup> quarter score was 86.55.

Table 1: Class Mean 2<sup>nd</sup> Quarter and 3<sup>rd</sup> Quarter Scores

Student Math Scores		
Student	2 <sup>nd</sup> Quarter	3 <sup>rd</sup> Quarter
1	92.4	92.3
2	91.6	91.5
3	81.1	74.8
4	75.7	73.1
5	93.2	85.1
6	98.4	98.2
7	95.9	92
8	82.8	83.1
9	86.3	81.5
10	95	93.9
Mean Score:	89.24	86.55

The paired samples statistic test is shown in Table 2. At the conclusion of this study, the mean test scores were compared from the two quarters. This test showed that there was a difference in regard to the self-regulated learning methods that were implemented during the 3<sup>rd</sup> quarter. The results of this study showed that the mean of the 2<sup>nd</sup> quarter scores was 89.24. The 2<sup>nd</sup> quarter scores reflect teaching without self-regulated learning. The 3<sup>rd</sup> quarter scores reflect teaching with self-regulated learning methods. The 2<sup>nd</sup> quarter scores were 2.69 points higher than the 3<sup>rd</sup> quarter scores. The result of the paired samples t-test showed a result of .018. This slight decline was significant as the null, identified as P, was below .05. The results showed there was a significant decrease in scores due to the self-regulated learning methods implemented during the 3<sup>rd</sup> quarter.

Table 2: Paired Samples T-Test

Paired Samples T-Test				
	Mean	N	Standard Deviation	P
Pre-Test Scores	89.24	10	7.02	.018
Post-Test Scores	86.55	10	7.97	

## Discussion

### Summary

The purpose of this study was to determine the relationship between self-regulated learning and a fourth grader's mathematic achievement. This study focused on the question "Does a self-regulated learning environment increase the achievement in math in fourth grade?" The data showed a negative relationship between these two variables. According to the data taken from the study, the achievement level decreased at the conclusion of this study. This study found no significant difference in the two quarters that were being evaluated. Therefore, the results failed to reject the null at the implementation of self-regulated learning.

This study looked at fourth grade students at a small Midwestern Christian school to check if the students' mathematics scores would increase once the students were taught using a self-regulated learning structure. The research indicated that when using self-regulated learning procedures, students' scores in school would improve (Boekaerts, 1997). However, this study showed a negative effect of self-regulated learning on mathematic achievement.

There were many reasons why this may have occurred. One reason could be that as a student progresses throughout the school year, the learning material became more difficult. According to the A Beka website, the description of the mathematics program states, “The colorful daily worksheets provide practice over familiar concepts and reteach the new material that the teacher has just taught. The four basic processes are taught and reviewed, as well as multiplying and dividing by two-digit numbers, estimation, square measures, writing decimals as fractions, and simple geometry.”(<http://www.abeka.com>). Because this study retrieved and compared scores from the second and third quarters, the third quarter learning material was a review of previous mathematics concepts that have been taught. In the teaching of this mathematics curriculum, the researcher identified that the main concepts were taught and introduced in the first and second quarters. During the third and fourth quarters, these main concepts were developed to provide more depth in the study of mathematics. Therefore, the level of difficulty may have led to a decrease in the student scores.

A second reason why the results were varied from the expected outcome found in research was type of teaching methods utilized. The structure of the classroom was varied greatly from the typical classroom the students generally were a part of. In years past, the students were required to do many worksheets through the A Beka curriculum. Through self-regulated learning, the students were encouraged to become engaged in the learning process. According to Lister, (2005), there is not one method that can teach all children, but when children are taught through their individual learning style, there is academic achievement. Through teaching with a self-regulated learning process, the students were required to learn in a specific way which varied from the traditional methods. The students weren't taught according to each of their specific learning styles, rather they were taught using the same self-regulated

learning method for each individual student. As a result, the self-regulated learning was so different from the experiences that these students had experienced thus far in their education, that the “leap” was just too great from controlled, prescriptive worksheets to self-regulation.

Lastly, the results may have varied from the intended outcome because of a limitation of time to develop the strategy. The lessons were short and the time to practice with the various strategies was limited. This may have been a factor since the students may not have had a good grasp on the techniques of becoming self-regulated.

## **Conclusion**

### **Implications**

The implications of this study are valuable for the field of education, not just in mathematics, but in all study areas. The results found through this study varied from what research suggests. Therefore, there is a need for another study to be conducted.

When another study is conducted there are changes that should take place for better results to possibly occur. First, understanding that there is a need for students to be self-regulated in their learning is vital. Today, there are many online classes being offered in which the students are required to regulate their learning. This study showed that when students are regulating their learning there is not a direct relationship to a higher achievement level. Second, it shows that there cannot be an instant change in grades when the teaching strategy is differentiated. To develop a concise understanding, the new strategy will take time and practice to develop the learners into confident self-regulated students.

With continued research on the achievement level of mathematics due to self-regulated learning methods, a researcher could conduct a very similar study. However, the researcher could start with self-regulated learning methods in the 2<sup>nd</sup> quarter and non-self-regulated learning in the 3<sup>rd</sup> quarter. These scores could be compared to determine if the results are due to the variance in self-regulated methods or if it was due to content being taught.

Finally, this research confirmed that self-regulated learning does not always produce a higher achievement level. This result has many contributing factors and possible reasons why this may have occurred. However, the researcher continues to argue that with the possible resources, time, and increased student population, the results of this study would have differed. The researcher would recommend that this study be done again as a longitudinal study using the same students over a three-year time span. This time would allow students to master the study strategy and understand the value of self-regulated learning. The shortest amount of time the researcher suggests would be two years. One year was not enough time to develop self-regulation in a classroom.

### **Limitations**

This research was limited due to the sample size. A sample size of ten students is not a large amount. An ideal sample size would be twenty or more students. More data would have provided the researcher with a larger amount of scores to compare with the scores that were collected in this study. Along with sample size, a limitation is that only one teacher participated in the study. Ideally, this study could be done in a school with two sections of each grade level. One teacher could teach the curriculum as prescribed in the textbook. The other teacher could teach mathematics with the implementation of self-regulation. This would allow more time to

develop the lessons and practice the skills taught in self-regulated learning. Because the teachers are working with students of the same age level, with the same scope and sequence, the accuracy of the study would be more concrete. It would also allow the teachers to discuss their findings, compare results, and identify the benefits or downfalls of self-regulation.

Another limitation is due to the duration of the intervention incorporating self-regulated strategies. The methods of self-regulation were taught for a short time period and in only one subject area. The mathematics textbook edition is *A Beka* which is a spiral curriculum. Therefore the material is taught and practiced continually rather than focusing on a specific mathematics skill to master before moving on. The units are not separate but are continual. Also the pre- and post-tests administered will be limiting due to the content being taught and the material which is covered.

The amount of support from the student's home will affect the outcome of each individual student. If they receive more support, students may be more motivated in their efforts and therefore can regulate their learning more productively.

Students are more apt to achieve higher scores at the middle of the school year in comparison with the end of the school year. This limitation may alter the scores of the impact that self-regulated instruction had on the students.

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## Appendix A

### Lesson 1: Subtracting fractions with unlike denominators

***\*\*Incorporating reciprocal teaching and cooperative learning for the self-regulation process\*\****

#### *Objectives:*

1. Students will access prior knowledge of borrowing and subtracting
2. Students will be able to find the least common denominators
3. Students will be able to borrow from the whole number
4. Students will be able to work together and teach one another the newly formed concepts through reciprocal teaching
5. Students will interact throughout the lesson with the teacher and peers
6. Students will accept responsibility for their learning

#### *Materials:*

3 x 5 note cards

Worksheet 177-178

#### *Focusing Activity:*

The concept of subtracting fractions is built on the prior knowledge of finding the least common denominator. To focus in on this new concept, the students will first play a game with the note cards to recall how to find the numerator and denominator.

The students will each get a 3 x 5 card. On one half, they will write out a subtraction problem with unlike denominators. On the other half, they will write the corresponding common

denominators. The teacher will collect the cards and pass them out in random order. The students will figure out the missing numerator. The class will check their work and this game will continue until all students have a solid grasp on finding the common denominators.

*Lesson Steps:*

1. Following the focusing activity, the teacher will hang the problems up on the board for students to see.
2. The teacher will take the cards down and cut them in half. Now the students will get the halves with the common denominators. The students will be instructed to work with a partner to reduce the fraction to its lowest terms. This answer will be written on the back side.
3. Working together, the students will find the reduced fraction while the teacher monitors the progress.
4. Once this activity is complete, the teacher will collect the cards and match them with the original fraction.
5. The teacher will orally work a problem out on the board while the students listen. The teacher will write the following problem on the board:

$$\begin{array}{r} \text{a. } 4\frac{1}{6} \\ - 2\frac{2}{3} \\ \hline \end{array}$$

6. The teacher will point out the 6 and 3 and mention that these are not alike. The students will be asked to find the least common denominator of 6 and 3. At this point, the teacher will explain because  $\frac{4}{6}$  cannot be subtracted from  $\frac{1}{6}$ , we must borrow 1 from 4 to get 3. We will rewrite the borrowed 1 as  $\frac{6}{6}$  to keep the common denominator. Then we must add the borrowed  $\frac{6}{6}$  to  $\frac{1}{6}$  to get  $\frac{7}{6}$ . We will then subtract  $\frac{4}{6}$  from  $\frac{7}{6}$  to get  $\frac{3}{6}$ . Subtract 2 from 3 to get 1. Then we must reduce  $\frac{3}{6}$  to  $\frac{1}{2}$  so our final answer is  $1\frac{1}{2}$ .
7. After working out the above problem, the board should appear like the example below:

$$\begin{array}{r} \text{a. } 4\frac{1}{6} = 3(\frac{6}{6}) + \frac{1}{6} = 3\frac{7}{6} \\ - 2\frac{2}{3} = -2\frac{4}{6} = -2\frac{4}{6} \\ \hline \hline \hline \end{array}$$

$$1\frac{3}{6} = 1\frac{1}{2}$$

8. The teacher will assign the following problem for the students to figure out on their whiteboards while working with their partner. The students will be encouraged to talk through what they are doing and explain each step as they go.

$$\text{a. } 8\frac{1}{4} = 7\left(\frac{4}{4}\right) + \frac{1}{4} = 7\frac{5}{4}$$

$$-3\frac{1}{2} = -3\frac{2}{4} = -3\frac{2}{4}$$

\_\_\_\_\_

\_\_\_\_\_

$$4\frac{3}{4}$$

9. When the teacher feels that the students have a good grasp on this new material, she/he will assign the homework assignment which works on these concepts. Allow the students 15 minutes of time to work while the teacher monitors. If there are questions, refer to the fractions on the board to find the least common denominators.

## Lesson 2: Changing Mixed Numbers to Improper Fractions

**\*\*Learning centers to encourage students to work independently in a non-threatening environment\*\***

*Objectives:*

1. Students will access prior knowledge of fractions
2. Students will be able to participate during classroom instruction to show a general understanding
3. Students will be able to work through the set-up centers and be responsible in the learning process
4. Students will be able to show an understanding for changing mixed numbers to improper fractions

*Materials:*

12 popsicle sticks per student

Markers

Paper with one horizontal line in middle of page

White board and marker

Notebook paper

Computer

*Focusing Activity:*

The teacher will write fractions on the board and have students recall if the fractions are proper or improper. The teacher will then explain that sometimes there are mixed numbers

where there is a whole number and a fraction. He/she will go on to demonstrate how to change a mixed number into an improper fraction. This will be demonstrated on the board a number of times until the students show an understanding of how the process works.

The teacher will go on to explain the 3 learning centers that will take place during math time. The first group will be using popsicle sticks to make improper fractions, the second group will be working on the computer practicing this skill, and the third group will be with the teacher working on similar problems.

*Lesson Steps:*

1. All students will be given 12 popsicle sticks. With markers, they will color one side of the sticks blue. The other side will be colored red. If students finish before others, they can help out their classmates.
2. The students will hear the directions and goals for each center.
  - a. Popsicle Stick Center:

For this center, the students will need the 12 popsicle sticks, paper with line drawn horizontally, notebook paper, and a pencil. The students will toss up the popsicle sticks and organize them by color once they drop. The red sticks will go on the top half of the paper, representing the numerator. The blue sticks will go on the bottom half of the paper, representing the denominator. The student will then write their fraction, improper or proper, on their notebook paper. If the fraction is improper, they will be asked to convert it to a mixed number so the fraction will be proper. This center will be aimed for students who are kinesthetic learners.

b. Felt Fractional Circles Center:

The students in the group will need a notebook paper and pencil for this center.

The students will look at cards with felt fractional circles glued on. They will write the mixed number that they see and convert it to an improper fraction.

There will be an example of how it should appear on their paper. This center is aimed for visual learners.

c. Teacher Center:

The students will need their white boards and markers for this center. The teacher will teach small groups how to change a mixed number to an improper fraction.

There will be reinforcement given as students will work through a number of problems with the teacher. This center will be designed for auditory learners.

*Closure:*

Following the time spent in centers, the students will go back to their desks and work out 3 problems as a class. The following problems will be worked out together:  $1\frac{3}{7}$ ,  $1\frac{7}{10}$ , and  $1\frac{5}{12}$ .

There will be more review the following day to reinforce this skill.

### Lesson 3: Multiplying Fractions

**\*\*Teach the strategies and skills that are necessary for independent work (peer collaboration and teacher support)\*\***

*Objectives:*

1. Students will access prior knowledge of fractions
2. Students will be able to ask questions and interact in the classroom activities to benefit their learning
3. Students will be able to multiply numerators and denominators
4. Students will be able to develop working relationships with their classmates as they learn to work together.

*Materials:*

Felt Fractional Circles or Pizza fraction circles

Whiteboard for each student

Worksheet page 187-188 from A Beka Arithmetic Worktext

Pencils

*Focusing Activity:*

The teacher will take the felt fractional circles and show  $\frac{8}{8}$ . The teacher will explain that this is a pizza and that we want to put pepperoni on  $\frac{3}{4}$  of the pizza. Ask the students how many pieces should have pepperoni. Write  $\frac{6}{8}$  on the board and remind students that we should always reduce. Therefore,  $\frac{6}{8}$  is the same as  $\frac{3}{4}$ . Continue with the story by saying that a student ate  $\frac{1}{2}$  of the pizza with pepperoni. How many pieces did he eat? The answer is 3. On the

board write  $\frac{1}{2}$  of  $\frac{3}{4}$  is  $\frac{3}{8}$ . Write it as a mathematical problem  $\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$ . Explain that we multiply the numerators together and the denominators together.

The teacher will then do another example. This time, the teacher will show  $\frac{6}{6}$ . The teacher will explain that this time we want to put mushrooms on  $\frac{1}{3}$  of the pizza. Ask: How many pieces should have mushrooms? 2. Write  $\frac{2}{6}$  on the board. Then continue by asking: How many pieces did a student eat if he ate  $\frac{1}{2}$  of the pizza with mushrooms? 1. Write  $\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$  on the chalkboard. Explain again that when we multiply fractions, we must multiply the numerators together and the denominators together to get the correct fraction.

*Lesson Steps:*

1. After going through the focusing activities, the teacher will hold up  $\frac{9}{9}$  of a felt fraction pizza. The teacher will ask the students to come up with a story.
2. Using the story prompts and guiding questions of the teacher, the students will work through a story problem together. The teacher will have the students write out the problem on their whiteboard.
  1. The teacher will pass out fraction pieces to the students and pair them up.
  2. The teacher will encourage students to work together to come up with a story. One student will write down the story that they will later share with the class.
  3. The teacher will monitor discussion and help students who have questions.
  4. The students will share their stories.
  5. The teacher will then pass out page 187-188. The students will continue working with their partners to complete this page. The teacher will continue monitoring students' understanding and answer any questions that the students may have.

*Closure:*

The students will turn in their assignments when complete. If students are finished before others, they can continue making up stories using the fraction pieces. Once everyone is complete, the teacher will write the following problem on the board:  $\frac{2}{3} \times \frac{4}{5} = ?$ . Have students copy the problem on their whiteboard and show the teacher the answer. Check for understanding. Ask if we can reduce and when we can't, this is our final answer.

## Lesson 4: General Review

**\*\*Provide pupils with opportunities for self-monitoring: feedback, goals, think-aloud, detect errors, observation measures\*\***

### *Objectives:*

1. The students will review concepts learned throughout the year
2. The students will interact and collaborate to answer questions
3. The students will answer a questionnaire about their progress
4. The students will teach the other members in our classroom

### *Materials:*

White board

Questionnaires, one per student

### *Focusing Activity:*

The teacher will remind the students everything that has been learned throughout the year: fractions, division, story problems, multiplication, reducing fractions, mixed numbers, and improper fractions. The teacher will then remind the students that some students may find certain things harder than other but God created each student differently. The teacher will then explain that part of his/her job is to make sure that the students understand what the class is learning. The teacher will pass out the questionnaire and ask the students to answer it as honestly as possible. The purpose of this questionnaire is to assess the students' competence and self-efficacy. This will be used as an instrument so the teacher can better understand where the student is at and what skills to reinforce during the class periods.

*Lesson Steps:*

1. Students will turn in their questionnaires which the teacher will review at a later time.
2. Throughout this lesson, the students will take on the role of teacher and the teacher will guide and ask questions to clarify the steps and to assess the students' knowledge. This strategy is think-aloud.
3. The teacher will then write the following problem on the board:  $\frac{2}{3} \times \frac{3}{4} =$ . The students will copy this on their white board but wait to work out the problem. The teacher will then call on a student to come to the front and explain the steps to solve this problem. As the student explains the steps, the teacher will ask questions to guide understanding. The students at their seats will work out the problem while the 'student-teacher' explains it up front.
4. This structure will continue throughout the class period. Different students will come up to explain different problems. Some examples of problems include, but are not limited to:  $\frac{1}{4} \times \frac{1}{3}$ ;  $5,306 \div 9$ ;  $1,639 \div 84$ ;  $4 \frac{2}{3} - 3 \frac{1}{6}$ ;  $16 \frac{1}{5} - 8 \frac{5}{10}$ ;  $\frac{6}{7} + \frac{1}{14}$ ;  $\frac{5}{24} + \frac{7}{12}$ ;  $329+675+892$ ;  $43 \times 65$ ;  $\$32.75 \times 9$ ;  $3,100 - 1,687$ .
5. The class will then review together how to convert fractions (ex.  $\frac{3}{4} = \frac{x}{12}$ ). The class will also review how to change an improper fraction into a mixed or a whole number (ex.  $\frac{11}{8} = 1 \frac{3}{8}$ )
6. Through the students teaching, the teacher will have a better idea of how well the students understand the information. In order for the students to understand these problems, they have to be able to orally explain them to the other students.

*Closure:*

At the conclusion of this lesson, the teacher will explain any areas that seemed more difficult for the students to work through. The teacher will ask if there are any questions or if there are any additional problems the students would like to practice. After the lesson is complete and when the teacher has a planning period, he/she will review the questionnaires to check students' competence and understanding of the material.

**Lesson 5: Cancellation: simplifying fractions before multiplying**

**\*\*Evaluation practices – give constructive feedback and provide ideas of how to solve the problem (review assignments, corrective feedback, compare their work with a set of standards.\*\***

*Objectives:*

1. Students will review multiplying of fractions and reducing the fraction to get the final answer.
2. Students will learn an easier method of reducing the fraction.
3. Students will practice this new skill.
4. Students will review the given assignment to check for mistakes and understanding.

*Materials:*

Page 199-200 from A Beka Arithmetic 4 Worktext

Pencil

Overhead Projector

Transparency of page 199-200

*Focusing Activity:*

The teacher will remind students that when we have been multiplying fractions, we have to look at the final fraction and see if it can be reduced. Then we have to go through an additional step to reduce it. Tell the students that they are going to time the teacher while the teacher does the problem in two different ways.

The teacher will write the following problem on the board:  $\frac{2}{3} \times \frac{1}{6} =$ . The teacher will then tell the students to begin timing. The teacher will work out the problem and have to reduce at the end. This way will take longer than if we would simply cancel. The students will tell the teacher how long it took. Write the amount of time on the board. Then write the problem again. This time cancel before multiplying. Explain the steps to the students while working it out. The time that it took to multiply using cancellation should take less time than the original way with reducing. Tell the students that this is what they will be learning to do.

*Lesson Steps:*

1. The teacher will write out the following problem on the board:  $\frac{5}{6} \times \frac{12}{15}$ . The teacher will then demonstrate step by step how we would reduce. First, explain that the numerator 5 and denominator 15 have a common factor of 5; therefore both are divisible by 5. Next look at the numerator 12 and denominator 6 and explain that the common factor is 6. Reduce these numbers down and multiply as usual.
2. Now that the procedure and steps have been demonstrated, the teacher will pass out page 199-200. The teacher will also get the overhead and transparency prepared to go through some problems together.
3. The teacher will go through the steps at the top of the page with the students. Then the class will do #1a together. The teacher will walk the students through the problem on the overhead while the students work on their worksheet.
4. The teacher will then give the students time to complete #1b-e on their own.

5. Once the students are complete, the teacher will go over each problem on the overhead while checking the students' work.
6. These procedures will continue for the entire worksheet.
7. This feedback and explanations of how to solve the problem will help the students as they become more familiar with self-regulation.

*Closure:*

The students will turn in their papers and the teacher will check if there are any additional questions. To ensure students' understanding, the teacher will have them do one last problem on their whiteboards to practice cancellation. If any students get the problem wrong, go through the steps again and continue giving problems until there is 100% accuracy.

## Lesson 6: Multiplying a Fraction and a Whole Number

**\*\*Self-reflection and support for newly acquired instruction – revise renew and reinforce new information \*\***

*Objectives:*

1. Students will access prior knowledge of fractions
2. Students will learn steps to solving the multiplication of a whole number and fraction
3. Students will be able to rely on prior understanding to comprehend new information
4. Students will be able to show an understanding of multiplying fractions
5. Students will be able to be proficient while working

*Materials:*

Whiteboards

Worksheet Assignment

*Focusing Activity:*

The teacher will refresh the students' memory of fractions. The class will review how to multiply fractions, reduce fractions, the difference between a whole number and a mixed number, and terminology relating to fractions. This will be done orally in the classroom before beginning the lesson.

*Lesson Steps:*

1. The teacher will write  $5/1$  on the chalkboard. The teacher will remind the students that the fraction bar is another way of showing division. Have students tell the teacher what 5 divided by 1 is. The answer is 5. The teacher will point out that when we take a whole number and put it over the denominator of 1, the whole number will remain the same.
2. On the board, the teacher will write the following problem  $2/3 \times 12$ . Have students copy this problem on their whiteboards.
3. The teacher will walk through the multiplication process with the students. First the students will make the 12 an improper fraction by placing a 1 beneath it. Next, the students will check for any cancellations. The students will then multiply as usual. Check the answers when complete. Answer will be 8.
4. Proceed with three other problems before passing out the worksheet for today's lesson. See the attached page for this assignment.
5. Allow students time to work on this assignment. While the students are working, stop by each student's desk and ask them to explain the process to you. If students are struggling, go through the steps again until they are confident in the work they are doing.

*Closure:*

The students will turn in their assignment and the teacher will grade it. In the next class period, the teacher will pass back the page and go over the answers with the students.

Name \_\_\_\_\_

**Worksheet: Multiplying a Fraction and a Whole Number**

*Remember the rule: To multiply a fraction and a whole number, change the whole number to an improper fraction by placing over 1.*

**1. Change problems to improper fractions.**

a.  $3 =$

b.  $16 =$

c.  $9 =$

d.  $4 =$

e.  $10 =$

**2. Multiply carefully.**

a.  $4 \times \frac{1}{2} =$

b.  $\frac{2}{5} \times 10 =$

c.  $\frac{3}{8} \times 4 =$

d.  $18 \times \frac{5}{6} =$

e.  $\frac{2}{7} \times 14 =$

f.  $15 \times \frac{1}{5} =$

g.  $7 \times \frac{3}{4} =$

h.  $10 \times \frac{1}{4} =$

i.  $\frac{3}{5} \times 15 =$

## Appendix B

Student Questionnaire

Name \_\_\_\_\_

Directions: Please color in one answer for each of the questions.

	Very Much	Somewhat	Undecided	Not Really	Not At All
1. Do you like math?	<input type="radio"/>				
2. Are you excited for math?	<input type="radio"/>				
3. Do you enjoy working with others?	<input type="radio"/>				
4. Would you rather work by yourself?	<input type="radio"/>				
5. Do you like teaching others?	<input type="radio"/>				
6. Have you learned in math this year?	<input type="radio"/>				
7. If given an assignment, could you complete it without help?	<input type="radio"/>				

## Appendix C

*Central Christian School*  
1910 East 30<sup>th</sup> Ave.  
Hutchinson, KS 67502  
(620)-663-2174

January 17, 2011

Dear Mr. and Mrs. \_\_\_\_\_,

I am currently working toward my Master's Degree in Curriculum and Instruction at Dordt College in Sioux Center, IA. As part of the program I will be conducting an action research project in my classroom using your children as participants in the study. The research will not alter any learning in the classroom.

The research is designed to change the way in which I teach by adding lessons that call for students to take responsibility for their learning. This study will look at mathematic scores of the students in the second quarter in comparison with the fourth quarter. During the time in between, students will be taught how to regulate their learning and rely on previous knowledge and understanding of mathematic concepts. Using the information from the study, our school and fourth grade in particular will know what teaching methods will best impact the mathematic instruction.

Once the research is complete, your child's name will not in any way be associated with the research findings. The information will be identified with a code number.

If you would like additional information concerning this study, feel free to contact me. Thank you for your cooperation.

Sincerely,

Dawn Eliserio

(712) 441-0177

Please sign on the line and return to school with child once you have reviewed this information.

Parent Signature: \_\_\_\_\_

**Dawn Kathleen Eliserio**

555 7<sup>th</sup> Ave NW  
Sioux Center, Iowa 51250

**Education**

M.Ed Curriculum and Instruction, Dordt College (2012)

B.A. Elementary Education, Dordt College (2003)

**Academic Employment**

2010 to 2011: Fourth Grade Teacher, Central Christian School, Hutchinson, Kansas

2006 to 2010: First Grade Teacher, Sioux Center Christian School, Sioux Center, IA

2005 to 2006: Second Grade Teacher, Ripon Christian School, Ripon, CA

2004 to 2005: First Grade Teacher, Ripon Christian School, Ripon, CA

2003 to 2004: Third Grade Teacher, Ripon Christian School, Ripon, CA

**Presentations**

2009: Homework and practice in Marzano's nine effective teaching strategies, Sioux Center Christian, Sioux Center, IA

**Professional Membership**

2006 to 2010: Iowa Reading Association