THE IMPACT OF VISUAL REPRESENTATION ON STUDENTS LEARNING OF, AND ATTITUDE TOWARDS SCIENCE VOCABULARY

by

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STATEMENT OF PERMISSION TO USE

In presenting this professional paper in partial fulfillment of the requirements for a master's degree at Montana State University, I agree that the MSSE Program shall make it available to borrowers under rules of the program.

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July 2014

DEDICATION

I dedicate this paper to my family. I love and appreciate each and every one of you, my husband, Tim, my parents, Don and Barb, and my father in law and mother in law, Jim and Marilyn. Their examples of dedication, hard work, and motivation have given me the support and strength to conquer this project. I know they are proud of me for this accomplishment. Thank you for your patience and strength.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

This action research project was designed to test if strengthening a word's meaning by increasing exposure time through visual representation would allow for comprehension of the overall concept to follow. It also takes a look at the effects visual representation has on a child's attitude towards vocabulary. The treatment unit consisted of additional exposure time of vocabulary words through visual representations and a day of review before the chapter test. The visual representations took place in the form of a concept wheel, Venn diagram, word map and web. Results of the study indicate that there was not significant growth between the treatment unit and the non-treatment unit.

INTRODUCTION AND BACKGROUND

For the past four years, I have been teaching fourth-grade in the East Helena School District. East Helena is three miles outside the capital city of Helena, Montana. To serve the 2,000 residents in the community, the K-8 district has a middle school and two elementary schools, providing an education to 1,150 students.

I teach at Radley Elementary School. Radley is a second through fifth-grade school, with an enrollment of 512 students. The majority of the population is Caucasian (86%). The remaining fourteen percent of the school's population is multi-racial (9%), Hispanic (3%), and African American (2%). Forty-two percent of the students are on free and reduced lunch plans. A majority of the students come from low-income households, but several students from high-income households open enroll into the district. Due to the diverse household situations, students come to school with varied background knowledge and academic skills.

As a teacher at Radley, it is my job to help students reach excellence. To do this, I am always looking for ways to improve student achievement.

Focus Question

The focus of my capstone research project is on the impact of student science vocabulary exposure through visual representation on student learning and attitudes. Vocabulary exposure time is limited within the science curriculum. I suspect the lack of knowledge retention with vocabulary is due to the quick exposure during the reading portion of a science lesson. The terminology is not mentioned again until close to test time. This leads me to believe science concepts are not truly comprehended. My focus question asks, "In strengthening a word's meaning by increasing exposure time through

visual representation, will a student's comprehension of the overall concept follow?" I am also asking, "How does visual representation of words affect a child's attitude towards vocabulary?"

CONCEPTUAL FRAMEWORK

Curriculum teacher manuals provide limited vocabulary exposure and inadequate tools for teaching a word's meaning. A word appears in the text and then vanishes again until the summative assessment. Not only do students lack vocabulary understanding, the comprehension of science concepts is deficient as well. The task at hand is to see if by strengthening a word's meaning through visual interaction, the comprehension of the overall concept will follow.

Vocabulary instruction takes place in all content areas. If a student is struggling to understand vocabulary during subject reading, odds are the child's grasp of the concept is lost (Christ & Wang, 2010). To be able to comprehend text, students need to understand a word's meaning (Rupley, Logan, & Nichols, 1999). Students are curious creatures and it is the job of the teacher to build a connection between this curiosity and the content area (Kibby, 1995). When new vocabulary words are presented in context, students are able to see the importance of the word. This newfound knowledge combined with student participation and continuous exposures allows for successful vocabulary learning (Towell, 1998). Once the development of meanings takes place, the student's understanding of the content will quickly follow (Rupley, Logan, & Nichols, 1999). This progression positively impacts a student's educational achievements (Christ & Wang, 2010; Dockrell, Braisby, & Best, 2007).

A vocabulary understanding is important in helping a child better comprehend. It is key that teachers need to be teaching vocabulary learning in a supportive manner because without a strong word based knowledge, students cannot handle the demands of the curriculum reading (Christ & Wang, 2010; Harmon, Hedrick, and Wood, 2005).

The learning of vocabulary is built off of prior knowledge. Background experiences are the key components in linking prior knowledge with new information (Rupley, Logan, & Nichols, 1999). The brain organizes thoughts by associating concepts and ideas together. When personal experiences are a part of this organization, it is referred to as schema. Without schema, students would not be able to link the new information with the old. It is the teacher's job to create a connection between the new information being taught with what the children already knows (Kibby, 1995). Due to individual experiences, students process information differently, creating differences in developmental growth between children (Dockrell, Braisby, & Best, 2007).

Characteristics of effective vocabulary instruction take place in the form of repetition, engagement and exposing words within their content. Then children need an opportunity to work with the word through hands-on, visual representations.

Repetition is important in the reinforcements of the word (Cudd & Roberts, 1994). Multiple exposures to a word's meaning should not only take place during the context of the term but should happen multiple times throughout the day, crossing over into other activities, as well (Harmon, Hedrick, & Wood, 2005). Through repetition, children are granted continuous opportunities to experience the word's meaning and become familiarized with the word (Christ & Wang, 2010; Kibby, 1995).

Entertaining and stimulating activities engage children while teaching new information. This engagement helps connect previous knowledge with newly discovered information (Smith, 2003). Engagement takes place when a child is interested in something. By stimulating the interest of a child, the teacher has caught the student's attention in a positive way. When a child is attentive to the materials being presented, words of interest become noticeable. This is showing the child is *word conscious* (Christ & Wang, 2010). Personal interest influences the way material is comprehended (Guthrie & Wigfield, 1999). When a child's interest increases, so does the thought process. Thus, engagement leads to advanced educational experiences (Guthrie & Wigfield, 1999; Wells & Narkon, 2011).

Students benefit from learning words in context because a stronger understanding of the word is created and the word is more likely to be retained (Biemiller & Boote, 2006). Once the word is understood, it is important to allow students the opportunity to use the vocabulary on their own. Providing this support through discussion, demonstrations and elaboration, the teacher is effectively encouraging word learning to take place (Christ & Wang, 2010; Rupley, Logan, & Nichols, 1999).

Once students have a basic understanding of a word, opportunities need to be available to advance the basic understanding. Being able to visualize and associate are powerful tools in strengthening the understanding of a word's meaning. For example, vocabulary word games engage students, while providing multiple exposures and a context to learning (Wells & Narkon, 2011).

Activities dealing with sight can help foster a child's need to categorize newfound knowledge (Rupley, Logan, & Nichols, 1999). Drawing is a helpful technique for both

the student and teacher. Cudd and Roberts (1994) observed first and third graders of all ability levels, who struggled with making a smooth transfer from book language into their own words. They experimented with different sentence manipulation activities and discovered sentence stems with the vocabulary allowed the students to build their own ideas. Once the word was understood, the student created personal art for the sentence. This helped solidify the terminology of the vocabulary sentence for the children. Cudd and Roberts concluded that when children create personal drawings associated with a vocabulary term, the drawing helps students recall the new word in a more concrete, personal manner. Drawing is also beneficial to students who cannot easily express their thoughts verbally. By creating illustrations a student displays understanding to the teacher of content knowledge (Dockrell, Braisby, & Best, 2007).

Students learn through different learning styles. Rupley et al.(1999) encourage the use of three different classroom-tested instructional techniques. All three techniques work with connecting prior knowledge with newly introduced material. The first technique, the concept wheel, starts with background knowledge and leads into brainstorming (Figure 1). This visual representation helps students see where a new word falls into play with words already known. The second technique, word mapping, focuses around a new word and at the same time categorizes ideas together (Figure 2). This process allows students to associate multiple words together, strengthening their understanding of a word's meaning. Similar to word mapping, webbing, the third strategy, works with association (Figure 3). However, with webbing, ideas and words are connected together. Concept wheels, word mapping and webbing all play a role in showing visual representation between the known and unknown (Rupley et al., 1999).

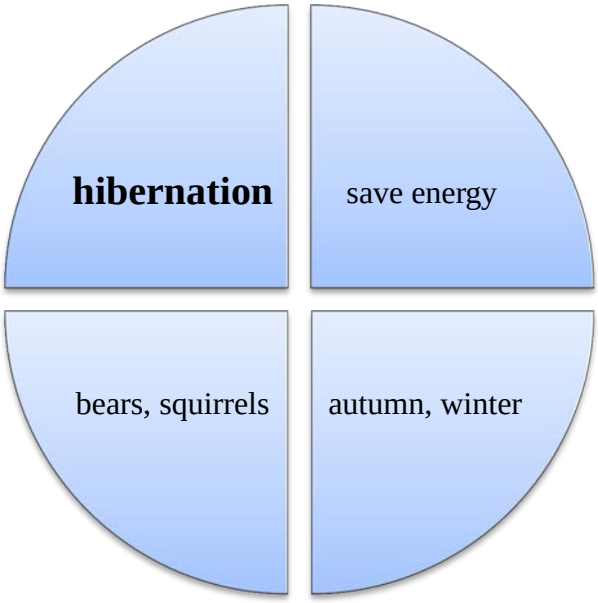

Figure 1. Concept Wheel

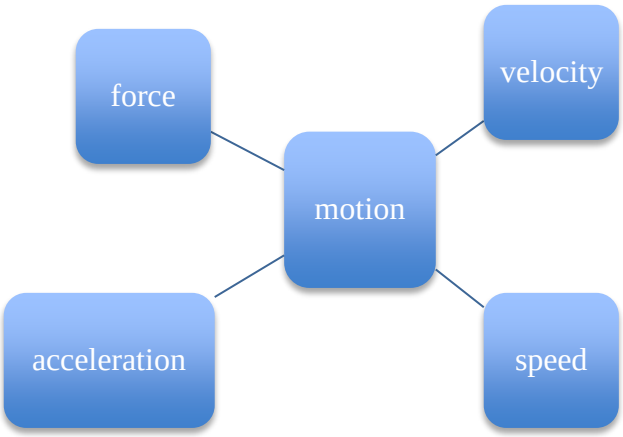

Figure 2. Word Map

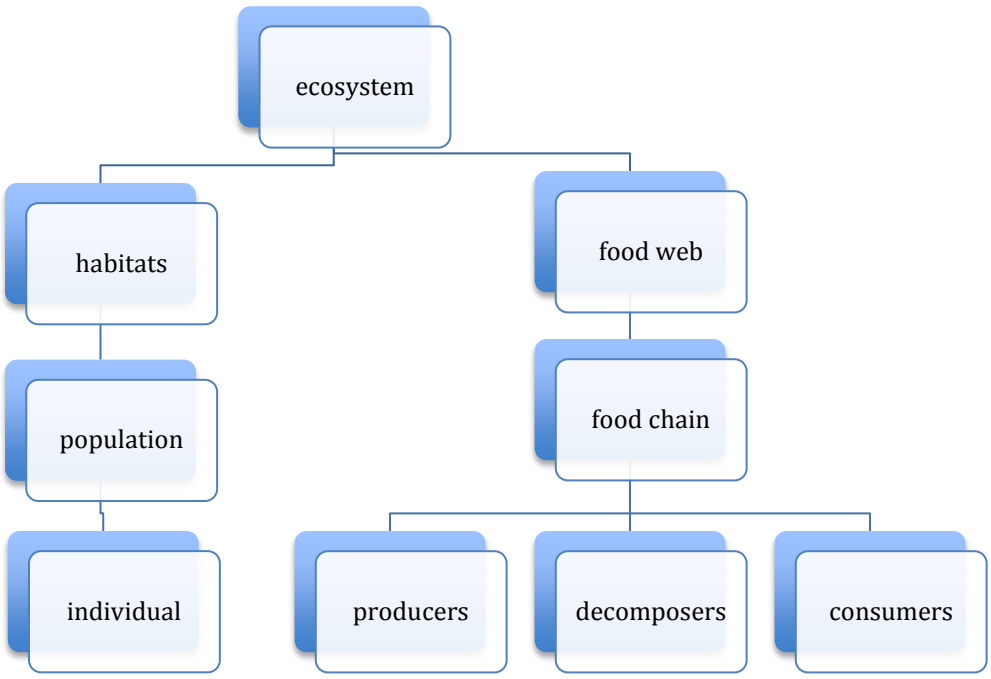

Figure 3. Web

To accomplish a stronger understanding of vocabulary, science lessons need to change. Motivation and engagement through visual representations need to entice the learner into the content. Through continuous repetition and a strong understanding of a word's meaning, a child's overall understanding of science concepts will be strengthened.

METHODOLOGY

My action research project centered on analyzing vocabulary successes. The treatment focused on the impact of vocabulary exposure through visual representations and an exploration of student attitudes towards vocabulary.

The action research project was conducted during an eight-week period in January and February of 2014. I selected two units, Earth Science and Physical Science, as my focus during the treatment period; Chapters Five and Six are part of the Earth Science

unit and Chapters Seven and Eight make up the Physical Science unit. Chapter Five and Seven made up the non-treatment unit and Chapters Six and Eight were used for the treatment unit. Each chapter within a unit was taught back-to-back and took approximately two weeks. A typical lesson took thirty to forty-five minutes. Each lesson consisted of an introduction of some sort, reading material, a lab and a textbook summary.

There was no comparison group during the treatment period because I only teach science to one fourth-grade class. The four chapters selected for my action research were selected because they cover similar concepts within each unit. Instead of a comparison group, I measured student growth of understanding from each chapter.

Participants

My twenty-four fourth grade students made up the treatment group. The class is evenly split between boys and girls, 46% boys and 54% girls. Around 32% of the students participate in the free and reduced lunch program. The majority of the class is Caucasian at 92% with the remaining 8% being 4% Native American, and 4% Native American - Caucasian. There is a range of ability levels within the class with four percent of students being pulled for special services throughout the week.

The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained.

Non-Treatment Unit

The first chapter in the Earth Science unit is Chapter 5: Earth's Resources and the first chapter in the Physical Science unit is Chapter 7: Matter. These chapters make up

my non-treatment unit. Students took a pre-test before starting the chapter. The pre-test was composed of content questions. I taught the chapter as suggested from within the teacher's manual. Using the suggested layout from the manual, students were expected to learn vocabulary words during a lesson and were not exposed to the words again until the end-of-chapter assessment. The chapters had twelve to fifteen vocabulary words the children were expected to know by the end of the chapter. A post-test on content was given following the last lesson of the chapter.

Treatment Unit

During Chapter 6: Earth and Space and Chapter 8: Energy and Heat, the treatment took place. The chapters consisted of twelve to fifteen vocabulary words. I implemented all vocabulary words in the treatment unit. The students took a pre-test on content for the chapter prior to instruction. One lesson a day was taught following the teacher's manual layout. However, during this chapter I implemented more vocabulary-focused activities. A concept wheel was used as a visual representation for both *ellipse* and *sound*. A Venn diagram was used to compare and contrast *lunar eclipse* and *solar eclipse*. The children used the word *energy* to create a word map categorizing the different types of energy they learned about. To help connect ideas and words together, the children constructed a web with *heat* being their focus word. I also used this time to provide multiple exposures to each vocabulary word. The last few minutes of class each day were used to review vocabulary introduced during that day's lesson and words from previous lessons. In addition, students had a day of review before taking the end of chapter content assessment. Table 1 shows an outline of each lesson, the vocabulary introduced during the lesson and what vocabulary activities took place throughout the lesson.

Table 1
Lesson Plan Layout

Questionnaire
Interviews

Unit 3 – Earth Science Chapter 5 – Earth's Resources Non-treatment Unit	Vocabulary Words	Vocabulary Skill
Pretest		
Lesson 1 How are minerals classified?	mineral, luster, hardness, streak, cleavage	
Lesson 2 How are rocks classified?	igneous, sedimentary, metamorphic	
Lesson 3 What are weathering and erosion?	landform, weathering, erosion	
Lesson 4 How can Earth's surface change rapidly?	Fault	
Lesson 5 Where is Earth's water?	Groundwater	
Lesson 6 What is the water cycle?	precipitation, water cycle	
Post Test		

Unit 3 – Earth Science Chapter 6 – Earth and Space Treatment Unit	Vocabulary Words	Vocabulary Skill
Pre Test		
Lesson 1 How does Earth move?	rotation, revolution, orbit, ellipse	• Vocabulary Review • Concept Wheel – ellipse
Lesson 2 How do star patterns change?	Constellation	• Vocabulary Review
Lesson 3 What are the phases of the moon?	eclipse, lunar eclipse, solar eclipse	• Vocabulary Review • Venn diagram – lunar eclipse & solar eclipse
Lesson 4 What is the solar system?	solar system, planet, asteroid, comet	• Vocabulary Review • Short story -

		astronaut touring solar system – incorporate vocabulary words into story
Review		• Vocabulary Review Game
Post Test		

Unit 4 – Physical Science Chapter 7 – Matter Non-treatment Unit	Vocabulary Words	Vocabulary Skill
Pre Test		
Lesson 1 What are properties of matter?	property, density	
Lesson 2 How is matter measured?	mass, volume	
Lesson 3 What are phases of matter?	phases of matter, melting point, boiling point	
Lesson 4 What are mixtures?	mixture, filtration, evaporation, condensation	
Lesson 5 How does matter change?	chemical change	
Post Test		

Unit 4 – Physical Science Chapter 8 – Energy and Heat Treatment Unit	Vocabulary Words	Vocabulary Skills
Pre Test		
Lesson 1 What are forms of energy?	energy, kinetic energy, potential energy	• Vocabulary Review • Word Map – energy
Lesson 2 What is sound energy?	sound, frequency, wavelength, pitch, volume, amplitude	• Vocabulary Review • Word Wheel – sound
Lesson 3 What is light energy?	refraction, reflection, absorption	• Vocabulary Review
Lesson 4 What is heat?	conduction, convection, radiation	• Vocabulary Review • Web – heat
Review		• Vocabulary Review Game
Post Test		

Data Collection

Data collection took place in many different forms throughout my action research. Before starting the research, I surveyed the students on their views towards vocabulary. This survey was conducted at the end of the two units, as well. The information from the two surveys was used to measure the students' opinions of vocabulary before and after the treatment was conducted. I also interviewed students regarding their attitude towards vocabulary in science before the treatment began and again after both units were completed. Six students made up my interviewees. A boy and girl from each ability level, high, average, and low, were selected to make up this team of six. Each chapter began with a pretest and wrapped-up with a post-test. Throughout the treatment, I collected data through activities that visually represented key vocabulary terms. Concept wheels, a Venn diagram, word mapping and webbing were all used as visual representation during these activities. A data triangulation matrix can be found in Table 2, showing what data sources were used for each focus question.

Table 2
Data Triangulation Matrix

Focus Question	Data Source 1	Data Source 2	Data Source 3
Primary Question: 1. In strengthening a word's meaning by increasing exposure time through visual representation, will a student's comprehension of the overall concept follow?	Pre-treatment and Post-treatment Student Surveys Pre-treatment and Post-treatment Interviews	Pre-test and Post-test per Chapter	Concept Wheel Venn Diagram Word Map Web
Sub-Question: 2. How does visual representation of words affect a child's attitude towards vocabulary?	Pre-treatment and Post-treatment Student Surveys	Pre-treatment and Post-treatment Interviews	

DATA AND ANALYSIS

The data collected during the study were divided into two themes: vocabulary exposure through visual representations and exploration of student attitudes towards vocabulary. In this section, I will examine these data through the lens of my two research questions.

Vocabulary Exposure through Visual Representations in Student Learning

During the non-treatment chapters, students had limited opportunity to learn key vocabulary terms. By following the teacher's manual, vocabulary words were introduced during a lesson and not discussed again until the end-of-chapter assessment. Chapter Five's, Earth's Resources, pre-test had a mean score of 4.25, with a standard deviation of 2.86. The post-test average for Chapter Five increased to 8.42 with a standard deviation of 4.44. The difference between Earth's Resources pre and post-test results was

statistically significant, t(46)=3.8626, p=0.0003. The mean score for Chapter Seven's, Matter, pre-test was 2.74, with a standard deviation of 2.09. The post-test for Chapter Seven had an average of 7.73 and a standard deviation of 3.84. The difference between Matter's pre and post-test results was statistically significant, t(43)=5.4382, p=0.0001.

I also calculated a gain score for each chapter. The non-treatment results were 42.81% for Chapter 5 and 56.49% for Chapter 7. The treatment test gain scores were 60.50% for Chapter 6 and 46.39% for Chapter 8. Based off of the results from the gain scores the data was inconclusive when comparing non-treatment chapters to treatment chapters (Figure 4).

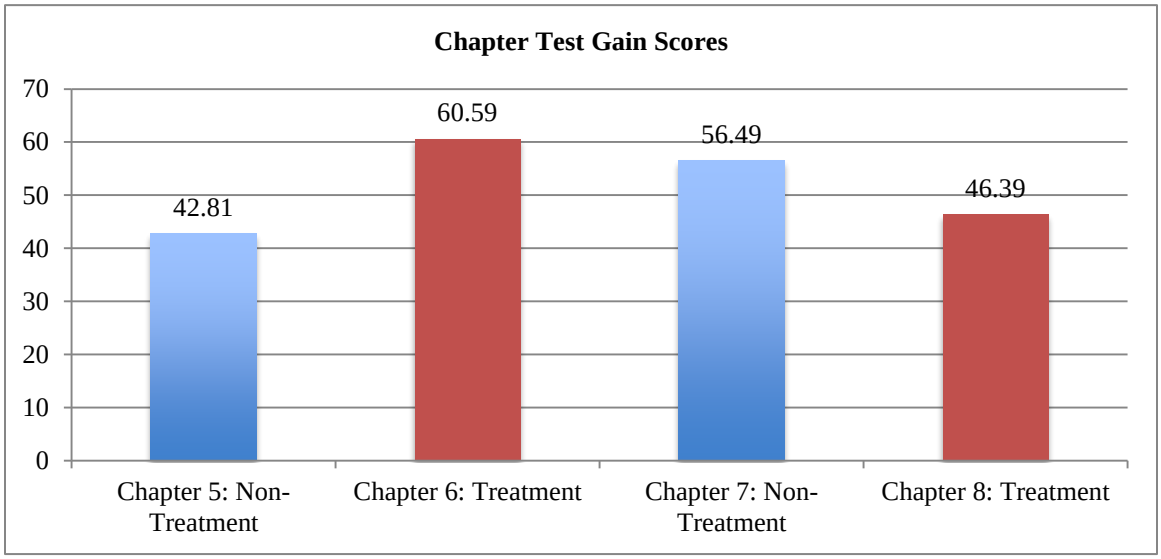

Figure 4. Chapter Test Gain Scores, (*N* = 24).

To help students understand vocabulary terms, different techniques were used to help visually represent the key vocabulary. A concept wheel was used with the term *ellipse*. Pre-test results showed that 12.5% of the class understood the word. Post-test results proved that 75% of the students could correctly define ellipse. A Venn Diagram was used to compare and contrast *lunar eclipse* and *solar eclipse*. Four percent of the

students correctly identified lunar eclipse in the pre-test, whereas, 54% were able to identify it on the post-test. Solar eclipse was correctly associated with its definition by 12.5% of the class. However, the post-test showed 58% of the students could correctly link solar eclipse with its definition. Twelve point five percent of students correctly identified *energy* on the pre-test. Following a word map activity focusing on the term *energy*, 62.5% of students correctly identified the term. During the non-treatment section of the research, students were taught the words through the text and the term was not revisited again until the post-test. Chapter Five's results showed the term *luster* was answered correctly by 8% of the students in the pre-test and by 58% of the students on the post-test. *Metamorphic* was also a definition on Chapter Five's test. Four percent of the students answered the question correctly on the pre-test, while 54% of the students answered it right during the post-test. Chapter Seven's results showed that both of the terms *volume* and *mass* pulled in the same scores. Students correctly answered the pre-test questions with 13% accuracy and the post-test results showed an accuracy rate of 59% on both terms. Again, this shows that the treatment did not have an impact on vocabulary learning beyond the non-treatment approach.

Exploration of Student Attitudes towards Vocabulary

The results of the Pre-Treatment Questionnaire and the Post-Treatment Questionnaire revealed that the majority of students saw a connection between understanding a vocabulary word and understanding a science lesson. The majority of students, 71%, either "agreed" or "often agreed" with the statement *Understanding vocabulary words helps me to understand the science lessons* on the Pre-Treatment Questionnaire (N = 24). Their opinions changed to 79% on the Post-Treatment

Questionnaire, showing positive growth in student perceptions of the importance of vocabulary (Table 3).

Students were asked during the questionnaire to rate the statement, *Vocabulary is important to learn in science*. During the pre-treatment phase, the statement was rated as "always true" by 58% of the students (Table 3), while during the post-treatment phase, 75% of the students felt it was "always true" (Table 3).

Students assessed the remark, *Learning science vocabulary is fun*. The pre-treatment results concluded that 54% of the students saw the reference as "often" or "always true" (Table 3). The post-treatment results revealed that 50% "often" or "always" found it true (Table 3). When asked why students didn't find vocabulary fun, the class complained about the effort it takes to complete the vocabulary activities.

Table 3
Likert Scale: Pre and Post Questionnaire (n=24)

	1 = Never		2 = Sometimes		3 = Often		4 = Always	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Vocabulary is important to learn in science.	0%	0%	8%	4%	33%	21%	58%	75%
I can comfortably use vocabulary words when talking with my classmates and teacher.	13%	0%	29%	37.5%	29%	16.7%	29%	45.8%
Understanding vocabulary words helps me to understand the science lessons.	0%	0%	29%	21%	33%	25%	38%	54%
Learning science vocabulary is fun.	17%	0%	29%	50%	29%	17%	25%	33%
I study the vocabulary	21%	12.5%	21%	17%	33%	37.5%	25%	33%

words at home before taking a test.								
The only way to learn vocabulary words is by writing definitions.	12.5%	25%	37.5%	21%	29%	25%	21%	29%

When interviewing the six students after the treatment took place, all six commented about the importance of using the tools we created (visual representations) to help them study for upcoming tests. When asked, *Is there a method of learning vocabulary words that works well for you? If so, what method?* Pre-treatment responses consisted of "I don't" or "the study guide". Following the treatment, all six students interviewed, mentioned how helpful revisiting the visual representations were before the test. One student painted a clear picture on how a visual representation helped in preparing for the test, "After breaking apart the word with the wheel (concept wheel), I didn't have to study the word anymore, it was stuck in my brain."

Also during student interviews, I asked, "Is it important to know and understand vocabulary words during science lessons? Why or why not?" Pre-treatment responses during the interview were vague and students had a hard time justifying their answers. Four students said no. While the other two said, "Yes, you do better" and "Yeah, I guess to do well on a test." However, during post-treatment interviews all six students agreed that vocabulary words are important to understanding a concept. One student went so far as to say, "Yes, because it gives more knowledge about the word." Another mentioned, "without an understanding you don't know what the question is asking and you won't be able to answer it."

INTERPRETATION AND CONCLUSION

After collecting and completing my data, I concluded that there was not a significant difference between vocabulary words taught with visual representation compared without. However, I do believe student perceptions on the importance of vocabulary increased due to the treatment.

When looking at the impact that visual representation had on vocabulary directly relating to specific questions on tests, I felt the different visual vocabulary techniques did not play a significant role in word understanding. When looking at the treatment questions to non-treatment questions that focused around vocabulary terms, there is no evidence that the students benefited more from the treatment. For example, when using a word map to understand the term *energy*, students improved their scores by correctly answering the question by 50% from pre to post-test. Yet, when no intervention took place on the word *luster*, four percent of the students answered the question correctly on the pre-test and 58% of the students answered it correctly on the post-test, showing growth of 50%. Using a Venn Diagram to compare and contrast *lunar eclipse* and *solar eclipse*, student scores improved by 45.5% from pre to post-test. And yet during a non-treatment chapter, both volume and mass pulled in scores improving from pre to post-test by 46%. Based off of the outcome from the post-questionnaire, students did acknowledge the importance of using the visual representation to help study for upcoming tests. So I do believe the visual representations had an impact on the students but did not have better results than the non-treatment.

According to Guthrie and Wigfield (1999), personal interest influences the way material is comprehended. Being that all four chapters ranged in concepts during the

treatment and non-treatment units, students' individual interests could have increased or decreased depending on the material being taught. Although a chapter may have been part of the non-treatment unit, a student's engagement may have been high due to their individual interest level. Both Guthrie and Wigfield (1999) and Wells and Narkon (2011) agree that engagement leads to advanced educational experiences.

Although student results dropped from the pre-questionnaire to the post-questionnaire on, *Learning science vocabulary is fun*. They explained it was not due to lack of being fun but because of the required effort it took to complete visual activity tasks. All three ability levels that were interviewed came to the conclusion after the treatment that vocabulary words are important to understanding a concept. During the student questionnaire, 17% more of the students agreed "always" to *Vocabulary is important to learn in science*, from pre to post-questionnaire.

I believe that students focused more on the effort it took to complete the visual representation and did not comprehend the knowledge being taught. Rupley, Logan and Nichols (1999), agree that once the development of meaning take place, the student's understanding of the content will quickly follow. This progression positively impacts a student's educational achievements (Christ & Wang, 2010: Dockrell, Braisby, & Best, 2007). Unbeknownst to them, I believe the children agreed that *Vocabulary is important to learn in science* because vocabulary understanding helped them to better grasp science concepts.

VALUE

Through this action research process, I have grown as an educator. I was able to observe, learn and evaluate how the students best take in information. From there, I was

able to take the information and analyze the outcome. Being able to analyze the way students best learn vocabulary words has helped me to better lay out my lesson plans in a manner that is most beneficial to the students.

My assessment technique has changed due to this action-based research. Pre-tests are now used routinely in my classroom, not only for science but across the curriculums. The students benefit from the pre-tests because they are able to see what knowledge they have going into a chapter and are able to compare their results with how much more they have learned after the material was taught. As a teacher, I benefit from the pre-tests because I am able to look over the most commonly missed questions from the pre-tests and focus on those points as my target words to focus on throughout the chapter. I approached this concept with my four-grade teammates and was able to prove the benefit of pre-tests.

I also believe the students benefited from participating in the research project. By participating in the pre-tests, the students learned to take ownership of their learning. Multiple times throughout the lessons, students would comment about seeing something in the pre-test. I heard multiple times, “It must be important because it was in our pre-test and now it’s in our lesson.”

Based off of the post-interview, the students all commented on the importance of using visual representations to help them study for upcoming tests. Although the research showed visual representation did not show a major benefit on test scores, I cannot help but wonder if maybe visual representations have a longer lasting effect than vocabulary words memorized for a test. This is a concept I would like to look further into during the next school year.

For the future, I would like to focus on student-led visual representations through notes and study guides, not just through teacher-led single-word activities. I hope through this technique, students will be able to develop the skill to begin implementing visual representations into additional subjects and future classes because they will feel confident with the learning technique and hopefully it's lasting effects.

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APPENDICES

APPENDIX A

PRE/POST QUESTIONNAIRE

Pre/Post Treatment Questionnaire

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

Please use the following system to rate each statement.
1 = Never
2 = Sometimes
3 = Often
4 = Always

1. Vocabulary is important to learn in science.
   1 2 3 4

2. I can comfortably use vocabulary words when talking with my classmates and teacher.
   1 2 3 4

3. Understanding vocabulary words helps me to understand the science lessons.
   1 2 3 4

4. Learning science vocabulary is fun.
   1 2 3 4

5. I study the vocabulary words at home before taking a test.
   1 2 3 4

6. The only way to learn vocabulary words is by writing definitions.
   1 2 3 4

APPENDIX B

STUDENT INTERVIEW QUESTIONS

Student Interview Questions

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

1. Do you understand the vocabulary words used in class and in your science homework assignments?

2. Is it important to know and understand vocabulary words during science lessons? Why or why not?

3. What do you do if you don't understand a vocabulary word during the reading?

4. Do you enjoy learning new vocabulary words? Why or why not?

5. How do you study vocabulary for an upcoming test?

6. Is there a method of learning vocabulary words that works well for you? If so, what method?

7. Is there anything else you would like to tell me about science vocabulary at this time?

APPENDIX C

CHAPTER 5: EARTH'S RESOURCES TEST

Name:
Science
Chapter 5: Earth's Resources

A. cleavage
B. erosion
C. fault
D. groundwater
E. hardness
F. igneous
G. landform
H. luster
I. metamorphic
J. mineral
K. precipitation
L. sedimentary
M. streak
N. water cycle
O. weathering

____ 1. natural, nonliving solid crystals that make up rocks

____ 2. the way the surface of a mineral reflects light

____ 3. how easily the surface of a mineral can be scratched

____ 4. color of the powder that a mineral leaves when it is scratched across a special plate

____ 5. property of minerals to break along smooth, flat surfaces

____ 6. rocks that form from molten rock

____ 7. rocks that form when layers of sediments settle on top of one another and harden

____ 8. process of rocks in Earth's crust slowly being broken into smaller pieces

____ 9. any water that is underground

____ 10. rocks that have changed as a result of heat and pressure

____ 11. process of carrying away weathered bits of rock

____ 12. any form of water that falls to Earth

____ 13. a natural land feature on Earth's surface

____ 14. a break or crack in rocks where Earth's crust can move suddenly

____ 15. the movement of water from Earth's surface to the atmosphere and back again

APPENDIX D

CHAPTER 6: EARTH AND SPACE TEST

Name:
Science
Chapter 6: Earth and Space

A. asteroid	G. planet
B. comet	H. orbit
C. constellation	I. revolution
D. eclipse	J. rotation
E. ellipse	K. solar eclipse
F. lunar eclipse	L. solar system

____ 1. spinning of a planet, moon, or star around its axis

____ 2. movement of one object around another

____ 3. path an object follows as it revolves around another object

____ 4. a shape that is like a circle stretched out in opposite directions

____ 5. star pattern

____ 6. event in which one object in space gets between the sun and another object

____ 7. event in which the moon passes through Earth's shadow

____ 8. event in which the moon passes between the sun and Earth

____ 9. the sun, the eight planets, and their moons, and other objects

____ 10. a very large, round object that moves around a star

____ 11. a rocky object that orbits the sun but is too small to be called a planet or a dwarf planet

____ 12. a frozen object that orbits the sun

APPENDIX E

CHAPTER 7: MATTER TEST

Name:
Science
Chapter 7: Matter

A. boiling point
B. chemical change
C. condensation
D. density
E. evaporation
F. filtration
G. mass
H. melting point
I. mixture
J. phase of matter
K. property
L. volume

____ 1. a characteristic of an object

____ 2. the amount of space that matter takes up

____ 3. the property of matter that compares an object's mass to its volume

____ 4. the form in which particles are arranged and move

____ 5. the measure of the amount of matter that makes up an object

____ 6. the temperature at which a substance changes from a solid to a liquid

____ 7. the temperature at which a substance changes from a liquid to a gas

____ 8. the change from a liquid into a gas

____ 9. a combination of two or more substances

____ 10. the process of a gas changing into a liquid

____ 11. the process of separating substances with a filter

____ 12. a change that produces a completely different kind of matter

APPENDIX F

CHAPTER 8: ENERGY AND HEAT TEST

Name:
Science
Chapter 8: Energy and Heat

A. absorption
B. amplitude
C. conduction
D. convection
E. energy
F. frequency
G. kinetic energy
H. pitch
I. potential energy
J. radiation
K. reflection
L. refraction
M. sound
N. volume
O. wavelength

____ 1. the ability to cause motion or create change

____ 2. energy in the form of vibrations passing through matter

____ 3. energy of motion

____ 4. number of waves that pass a point in a certain amount of time

____ 5. energy that is stored in an object

____ 6. distance between a point on one wave and a similar point on the next wave

____ 7. how high or low a sound is

____ 8. the bending of light when it passes into a new medium

____ 9. the transfer of heat that occurs when one thing touches another

____ 10. a measure of how strong a sound seems to us

____ 11. occurs when an object takes in light waves

____ 12. the transfer of thermal energy as matter moves

____ 13. the height of a wave measured from it's midline

____ 14. occurs when light rays bounce off a surface

____ 15. energy that is sent out in waves

APPENDIX G

INSTITUTIONAL REVIEW BOARD: EXEMPTION APPROVAL LETTER

MONTANA STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects
FWA 00000165

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Chair: Mark Quinn
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Administrator:
Cheryl Johnson
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cheryljj@montana.edu

MEMORANDUM

TO: Camilla Dusenberry and Eric Brunsell

FROM: Mark Quinn, Chair Mark Quinn CJ

DATE: November 4, 2013

RE: "*Visual Representation of Science Vocabulary and Student Attitude Towards Vocabulary*" [CD110413-EX]

The above research, described in your submission of November 4, 2013, 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 H

ADMINISTRATOR EXEMPTION LETTER

Administrator Exemption Regarding Informed Consent

I, Joe McMahon, Principal of Radley Elementary School, verify that the classroom research conducted by Cary Duserberry is in accordance with established or commonly accepted educational settings involving normal educational practices and that I approve the project. It is not necessary to get written assent from students and consent from student parents for participation in the study. To maintain the established culture of our school and not cause disruption to our school climate, I have granted an exemption to Cary Duserberry regarding informed consent.

Joe McMahon Principal Radley Elementary

(Signed Name, Title of Position)

Joe McMahon

(Printed Name)

10-22-2013

(Date)