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How Does Pre-teaching of Vocabulary and the Use of Technology Increase Student Learning in Science

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HOW DOES PRE-TEACHING OF VOCABULARY AND THE USE OF TECHNOLOGY INCREASE STUDENT LEARNING IN SCIENCE

by

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HOW DOES PRE-TEACHING OF VOCABULARY AND THE USE OF TECHNOLOGY INCREASE STUDENT LEARNING IN SCIENCE

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Understanding science vocabulary is one of the key components leading to student success in mastering science content. This study looks at the research surrounding pre-teaching vocabulary and the use of technology in the classroom. The purpose is to further investigate and deepen knowledge of science vocabulary. This research will use mixed methods of data collection. The study reports aggregated data on twenty-seven students of varying academic levels and needs (Regular Education, English Language Learners (ELL), Special Education), within Team 6A, of the 6th grade and data for seven students, who consented for the project, will be evaluated further, through a weekly vocabulary pre- and post-test, content tests, and with the Northwest Evaluation Association (NWEA) Measure of Academic Progress (MAP) Science Growth test to be taken in the fall, winter, and spring. Vocabulary will be presented to students through the use of a Keyword/Information/Memory clue (KIM) chart for pre-teaching, technology programs for investigating meanings and deepening knowledge, and review practice.

Keywords: pre-teaching, technology, science vocabulary

DEDICATION

This is dedicated to my daughter Brooke, who inspired me to continue to learn and want to do my best, even when something was hard and took a lot of work. My husband Steve, who made sure that everything was taken care of while I was working on my degree. To everyone that believed in me and encouraged me that this was something that even after so long I could accomplish. And last but not least, thank you to all of my NebraskaSTEM cohorts. I would not have made it without each and every one of you!! You all have played a part in this being completed, and I thank you all for making me laugh, think about things in a different way, and more importantly for your friendship.

GRANT INFORMATION

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TABLE OF CONTENTS

ABSTRACT ..... **II**

DEDICATION ..... **III**

GRANT INFORMATION ..... **IV**

CHAPTER 1: INTRODUCTION **1**

PROBLEM STATEMENT 1

PURPOSE AND RESEARCH QUESTIONS 2

CHAPTER 2: LITERATURE REVIEW **4**

OVERVIEW 4

USE OF TECHNOLOGY WITHIN THE CLASSROOM IMPROVES STUDENT OUTCOME GAINS 7

SUMMARY 8

CHAPTER 3: METHODS **10**

OVERVIEW 10

Vocabulary Pre- and Post-tests and Content Tests 13

DATA ANALYSIS 14

SUMMARY 16

CHAPTER 4: FINDINGS **17**

OVERVIEW 17

STUDENT VOCABULARY AND CONTENT TEST SCORES 18

STUDENT NWEA MAP SCIENCE GROWTH TEST SCORES 22

SUMMARY 24

CHAPTER 5: DISCUSSION AND CONCLUSIONS 26

OVERVIEW 26

DISCUSSION 26

CONCLUSIONS 28

LIMITATIONS 28

FUTURE RESEARCH 29

REFERENCES 30

APPENDIX A: KEY WORD/IDEA, INFORMATION/DEFINITION, MEMORY CLUE (KIM)CHART EXAMPLE AND SAMPLE STUDENT WORK USING THE CHART 32

APPENDIX B: STUDENT INTERVIEW QUESTIONS 36

APPENDIX C: TEACHER FIELD JOURNAL QUESTIONS CONSIDERED 37

LIST OF TABLES

TABLE 1 13
TABLE 2 14
TABLE 3 23

LIST OF FIGURES

FIGURE 1. VOCABULARY AND CONTENT TEST SCORES FOR STUDENT 1. 18
FIGURE 2. VOCABULARY AND CONTENT TEST SCORES FOR STUDENT 2. 19
FIGURE 3. VOCABULARY AND CONTENT TEST SCORES FOR STUDENT 3. 19
FIGURE 4. VOCABULARY AND CONTENT TEST SCORES FOR STUDENT 4. 20
FIGURE 5. VOCABULARY AND CONTENT TEST SCORES FOR STUDENT 5. 20
FIGURE 6. VOCABULARY AND CONTENT TEST SCORES FOR STUDENT 6. 21
FIGURE 7. VOCABULARY AND CONTENT TEST SCORES FOR STUDENT 7. 22
FIGURE 8. PARTICIPATING STUDENTS NWEA MAPS SCIENCE GROWTH TEST SCORES ALONG WITH EXPECTED GRADE LEVEL SCORES AND CLASS AVERAGE. 23

CHAPTER 1: INTRODUCTION

Problem Statement

Does the use of pre-teaching strategies for vocabulary and the use of technology increase student learning in science? Knowing vocabulary and understanding it is an integral part of grasping science concepts. As schools start to move into the use of the Next Generation Science Standards (NGSS), it is important for students to know relevant science vocabulary and be able to apply it within science concepts.

The use of vocabulary pre-teaching strategies as well as the use of technology in the classroom are some ways to increase students' knowledge of pertinent vocabulary and allows them to better understand concepts. Rupley and Slough (2010) found that essential capabilities necessary for understanding informational texts are prior knowledge to connect with what is read and learned, vocabulary knowledge to understand the concept laden words that are esoteric to the subject, and metacognitive skills to monitor learning. Young (2005) also found that students' first requirement for understanding what they read in science is to understand the language (i.e., vocabulary of the content) within text and classroom instruction in which their science material is presented. Students' level of understanding concerning their science vocabulary is an excellent predictor of their ability to understand science text. By using prior knowledge and building background knowledge, this facilitates students' comprehension of science text, vocabulary, and key concepts (Young, 2005).

One way in which students can be motivated to learn and review Science vocabulary is through the use of technology as a means to learn definitions and then work

with and review the terms. It was found that "expert" teachers, in the use of technology within their classroom, used various forms of technology, such as the internet to do research, desktop publishing software, and the use of computers in the writing process, to provide intellectually exciting educational experience for students (Berg, Benz, Lasley, & Raisch, 1998).

Purpose and Research Questions

Students often come into classrooms without the vocabulary or background knowledge needed to be successful at mastering science concepts. In order for students to grasp content information, it is of utmost importance that the initial mastery is of understanding the vocabulary. Too many times, teachers, dive into the *meat and potatoes* of our lesson wanting to impart great knowledge of the subject on to our students, but we forget that we must first *set the table* for them to be able to consume that knowledge. This *setting of the table* is done through pre-teaching vocabulary and using technology programs, such as Quizizz.com, that allow students to review individually to deepen knowledge of the vocabulary words.

The purpose of this study is to investigate: How does the use of pre-teaching of science vocabulary with the use of a Key words/ideas, Information/definition, and Memory Clue (KIM) chart and the use of technology, such as Quizizz.com, to use and review these words impact overall understanding within science content for sixth grade students?

Methods Overview

In this study, technology was used as a way for students to find definitions for designated vocabulary words, to apply and recall these words and their meanings, and also as a way to take pre-and post-tests over the vocabulary, content tests, and a standardized test. Students were interviewed in a one on one setting with their answers recorded and a field journal was kept by the teacher. (See Appendix B and C for copies of questions for each of these.)

Definition of Key Terms

KIM chart: chart used to record Key words/ideas, Information/definitions, and Memory Clues. Strategy used for pre-teaching of vocabulary words.

NWEA MAP: Northwest Evaluation Association Measure of Academic Progress. A standardized test used to show students' academic growth throughout the school year.

RIT scores: Rasch UnIT, measurement scale developed to simplify the interpretation of test scores.

NGSS: Next Generation Science Standards.

ELL: English Language Learner, student whose native language is not English.

SpEd: Special Education, student who receives Special Education services of some sort.

CHAPTER 2: LITERATURE REVIEW

Overview

"Vocabulary is the best single indicator of intellectual ability and an accurate predictor of success at school." (Elley, 1989 as cited in McGlynn & Kozlowski, 2017, p. 88)

As stated above by Elley (1989), student understanding of vocabulary is an accurate predictor of how successful students will be throughout their academic career. Science vocabulary can be very difficult to learn due to a high number of terms being highly technical. These are words that are not usually part of our everyday language or are words that have multiple meanings in everyday language, but have a more specific meaning when used in science texts (Aronin & Haynes-Smith, 2013). Words such as hypothesis, photosynthesis, mitochondria, organelle, or deoxyribonucleic acid are not words that most students hear in their daily lives, but rather are words that they must recognize and understand when working with different science content. Different strategies, such as the use of KIM charts, to pre-teach vocabulary, and the use of technology within the classroom can help equip students to obtain this success, including the understanding of science content.

Research relating to this topic was found through using Google Scholar using the terms pre-teaching of vocabulary, technology in the classroom, vocabulary and technology. Reviewing related literature reviewed two major themes: pre-teaching of vocabulary is an effective way to improve academic performance, and using technology within the classroom improves student outcome gains. Much of the information found was tied more to the pre-teaching of vocabulary within the academic area of

Reading/Language Arts, but also pertains to the importance of doing the same thing within teaching science.

Pre-teaching of Vocabulary, Effective Way to Improve Academic Performance

Vocabulary is crucial in the teaching of science content and without an understanding of the science terms, it is challenging for students to grasp important concepts. Because our classrooms contain such a wide variety of learners with diverse background knowledge, it is of great importance that all students have the same understanding when it comes to vocabulary.

For students to acquire the new terms, repeated exposure is needed in meaningful contexts. Such context would be such as those provided in a language or word-rich environment, where students are given the opportunity to read, hear, use, and talk about new vocabulary that they have learned, and the opportunities are many and varied (Blachowicz, Fisher, Ogle, & Watts-Taffe, 2006). This is done, so that connections can be made to prior knowledge and experiences, and can be accomplished through the pre-teaching, explicitly teaching of vocabulary, before lessons or activities (McGlynn & Kozlowski, 2017).

Several pre-teaching strategies have been found to be effective in improving academic performance of students, especially those with learning disabilities, in primarily lecture or reading-oriented content areas of instruction. Many students with disabilities and other struggling learners show delayed progress in science achievement. In 2009, the National Assessment of Educational Progress found that, among students with

disabilities, 49% of fourth graders and 70% of twelfth graders were performing in the "below basic" range in science (Berg & Wehby, 2013).

Berg & Wehby, (2013) noted, as found by Bos & Anders, (1990), that effective pre-teaching can provide additional time spent actively engaged with content material and can help by reducing the need to spend extra time reteaching material to students who struggle with concepts during regular instruction. Pre-teaching also gives the teacher an opportunity to supplement their typical teaching style with explicit instruction or other instructional procedures for students who are unable to grasp concepts, so that it better meets students' learning styles (Berg & Wehby, 2013). This happens when teachers use research-based strategies, that when implemented effectively, can improve students' access and ability to benefit from content area instruction (Berg, & Wehby, 2013).

Establishing vocabulary is an important factor that influences success both in and out of school. Word knowledge represents the hooks on which learning is hung on, and these hooks are essential to content acquisition and continual growth. It is very important that the needs of all learners are met and that all students possess the reading vocabulary and background knowledge to actively engage in science learning (Rupley & Slough, 2010). Students' level of understanding, concerning their science vocabulary, is an excellent predictor of their ability to understand science text (Young, 2005).

It is important that different approaches and ways are used for science vocabulary to be taught, as students will use prior knowledge, and building background knowledge helps to facilitate students' understanding and comprehension of the science text, vocabulary, and key concepts (Young, 2005). Teaching content-area science vocabulary

through a variety of inquiry methods and engaged word-meaning concept strategies allows learners to make connections while gaining an understanding of the science content (Young, 2005). One such strategy would be the use of mnemonic keywords. This is when students mentally create images using the words and their meanings. These mental pictures can then be transferred to things such as the Memory Clue section of a KIM chart. KIM stands for key word/idea, information/definition, and memory clue. It is a personal way for that student to remember the word and what it means. Students are then able to associate these images with the terms. Students then use technology to create PowerPoint/Google Slides flashcards, using the images, terms, and their meanings (Aronin & Haynes-Smith, 2013).

Use of Technology within the Classroom Improves Student Outcome Gains

Research-based principles of learning indicate that motivation to learn, as well as optimal novelty and difficulty, relevant to personal interests, while given opportunity for personal choice and control influence how much is learned (McKnight, O'Malley, Ruzic, Horsley, Franey, & Bassett, 2016). When given a choice and control of their learning process, students' participation and motivation to learn tend to be higher, which then correlates to improved learning (McKnight et al., 2016). When given the choice, students often times will choose to play a review game on their device rather than to review in a different way. This gives them instant feedback and they tend to find it more enjoyable, as they have control over their learning, and to them it is in a fun way that they are familiar with.

Computer software that was used for higher order thinking activities (such as interpreting data, reasoning, writing, solving concrete, complex, real-world problems and

conducting scientific investigations), used in an exemplary way can result in students learning to think, write, and problem-solve better. Optimal use of computer resources, for maximizing student outcomes, occurs when computers are used in these ways (Becker, 1994).

Exemplary computer-using elementary school teachers are using technology in their classroom. Many teachers use technology to motivate and keep students interested and experiencing success. On a 6-point scale, with 6 being the highest score, teachers felt that drill and practice programs had an importance rating of 4.62. This supports the use of technology in the classroom for individual review as well as using it to think, write, and problem solve for deeper learning and understanding of content (Berg et al., 1998).

Pedagogical beliefs supporting classroom use of technology by teachers who considered themselves to be exemplary in technology use can be used in best practice ways that benefit their students and their needs. There is no one technology resource or educational experience necessary for exemplary technology use to occur, but rather the teachers must embrace the vision that encompassed multiple emphases, depending on the perceived needs of their students and requirements of their job (Ertmer, Gopalakrishnan, & Ross, 2001).

Summary

"Vocabulary is the best single indicator of intellectual ability and an accurate predictor of success at school." (Elley, 1989 as cited in McGlynn & Kozlowski, 2017, p. 88). Student understanding of vocabulary is an accurate predictor of how successful students will be throughout their academic career. Science vocabulary can be very difficult to learn due to a high number of terms

being highly technical. These are words that are not usually part of our everyday language or are words that have multiple meanings in everyday language, but have a more specific meaning when used in science texts (Aronin & Haynes-Smith, 2013).

Different strategies, such as the use of KIM charts, to pre-teach vocabulary, and the use of technology within the classroom can help equip students to obtain this success, including the understanding of science content.

For students to acquire the new terms, repeated exposure is needed in meaningful contexts. Such context would be such as those provided in a language or word-rich environment, where students are given the opportunity to read, hear, use, and talk about new vocabulary that they have learned, and the opportunities are many and varied (Blachowicz, Fisher, Ogle, & Watts-Taffe, 2006). This is done, so that connections can be made to prior knowledge and experiences, and can be accomplished through the pre-teaching, explicitly teaching of vocabulary, before lessons or activities (McGlynn & Kozlowski, 2017).

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CHAPTER 3: METHODS

Overview

The purpose of this study is to investigate: How does the use of pre-teaching of science vocabulary with the use of a KIM chart and the use of technology to use and review these words impact overall understanding within science content for sixth grade students?

To investigate the impacts of pre-teaching vocabulary words and the use of technology on student learning of Science, this study utilizes an action research approach to analyze and collect qualitative data. An identical pre- and post-test on vocabulary words, that is multiple choice, was given weekly and/or at the beginning and end of each content area. This test was given using Google Forms, on student chromebooks, to record quantitative data and to collect a baseline of students' science vocabulary knowledge that was used within science content. Pre-teaching weekly vocabulary was done using a KIM chart, definition sheet, and textbook glossary or online dictionary site such as dictionary.com, or something similar, to look up meanings. The use of technology to review vocabulary words using Quizizz.com took place throughout each week. This allowed students an opportunity to use vocabulary words, and show understanding of meaning, in a way that they will also be able to use as a tool to learn and review. At the end of the week, a multiple choice vocabulary test using Google Forms on student chromebooks, was given to evaluate student understanding of vocabulary words used during that week and grades were recorded. Throughout as students are discussing terms with partners and using technology to review, field notes by the teacher, were recorded to refer to from week to week to make sure that strategies used are the most helpful to all

students. Overall Science content knowledge was assessed with the use of the NWEA MAPS Science Growth test to be administered in the fall (September), winter (January), and spring (May). Data will then be examined to see each student's growth throughout the year.

Context of the Study

This study will take place in the larger rural community of Fremont, in Eastern Nebraska. This diverse community is the county seat for Dodge County, with a population of approximately 26,500. Fremont is conveniently located approximately 40 miles from Omaha and 50 miles from Lincoln, which lends to jobs, out of school educational opportunities, and amenities, that may not be available in Fremont. Fremont Public School District covers approximately 60 square miles and is made up of one high school, one junior high school, one middle school, seven elementary schools, as well as an early childhood and learning center that serves approximately 4,736 students. According to the Nebraska Department of Education, in comparison to state totals during the 2017-2018 school year, Fremont has a higher mobility rate at 16.76% compared to 11.08% for the state, as well as Special Education and ELL population 18.69% in comparison to 15.12% and 11.93% compared to 6.87%, respectively. In addition to these factors, Fremont Public Schools also has a higher percentage of students receiving Free/Reduced rate lunches. The state average for 2017-2018 in this category was 45.83%, where Fremont had a rate of 61.02%.

This study took place in the spring semester of the school year. During the month of March, while the study was being conducted, Fremont was one of the many communities majorly affected by flooding. For several days, Fremont was in a sense an

island as there was no way in or out of the community, except by plane. For some students involved in the study, their homes were either damaged or destroyed and had to stay with someone that they knew or in shelters. Some students had parents stranded in other towns, due to having jobs outside of the community, and they were not able to get back to Fremont for several days. This also caused some students that were involved in the study at the beginning to have to move away.

Participants

Participants in the study include 87 sixth grade students, within the Fremont Public Schools district that attend Johnson Crossing Academic Center. Students of varying academic levels (Regular Education, ELL, and Special Education) and needs within the author's four Science classes. Data for seven students, who consented to participate in the research study are evaluated further. One thing to note: four of the seven students who consented for the project have family members who are involved in the education profession.

Data Collection

Vocabulary pre- and post-tests were given at the beginning and end of each content area, through the use of Google forms, to see the amount of change in student understanding of each vocabulary word. Questions on this test was multiple choice and students were required to identify proper meanings of vocabulary words that were used within content during the time that the content area is being discussed. Quizzes covering vocabulary words discussed that week were given with Google forms and grades were recorded. Data was also collected with NWEA MAP Science Growth Tests to be given in the fall (September), winter (January), and spring (May). A journal was written during

the week while observing students and their use of vocabulary words in class, there successes or struggles on Quizizz.com, what vocabulary words were being used correctly in everyday or classroom conversations, successes and failures within instruction and frustrations that had from being the instructor and the evaluator at the same time. Students were also interviewed at the end of the evaluation time about their views of science, how they perform in science, and some general questions about vocabulary in science.

Vocabulary Pre- and Post-tests and Content Tests

Table 1

Average vocabulary post-test scores, change in test scores, and content test scores for participants

Test Number	Average Vocabulary Post-test Score	Average % of Change in Vocabulary Test Score	Average Content Test Score
Test 1	100%	+ 17.6%	97.1%
Test 2	98.7%	+ 34.9%	85.9%
Test 3	100%	+ 35%	100%
Test 4	100%	+ 39.1%	98%
Test 5	96%	+ 34.7%	84.6%
Test 6	100%	+ 51.4%	92.9%
Average for 6 tests	**99.1%**	**+35.45%**	**93%**

Source: Test data for seven student participants.

Table 2

Northwest Evaluation Association Measure of academic progress science growth test data for participants

Student	**Fall Rit Score**	**Spring Rit Score**	**Amount of Growth**
Grade Expectation	204	209	+5
Class Average	206	208.1	+ 2.1
Student 1	222	224	+ 2
Student 2	227	237	+ 10
Student 3	197	203	+ 6
Student 4	217	219	+2
Student 5	213	214	+ 1
Student 6	223	231	+ 8
Student 7	204	215	+ 11
Participant Average	**214.7**	**220.4**	**+ 5.71**

Source: Participating students NWEA MAPs Science Growth Test Results

Data Analysis

The pre- and post- vocabulary tests, content tests, and NWEA MAPS Science Growth tests gives the researcher quantitative data that can be evaluated on a regular basis. Data from the pre- and post-vocabulary tests were used to find the student's understanding of words and their meanings that were being used every day in class while discussing content material. Data on the pre- and post-vocabulary tests were calculated by the items that were correct in each, and then looking at the amount of growth between the two tests.

The data from the content tests was used to evaluate the student's understanding of science concepts over a variety of different areas of science. Scores were calculated by the number of questions answered correctly. And then any questions that were missed were evaluated to see if it was a question pertaining to vocabulary or another science concept.

The data from the NWEA MAP Science Growth Test was used to see the student's growth over broad science topics throughout the entire school year. Students' scores were also looked at to see if they were scoring below, on, or above the expected RIT scores for students at their grade levels.

Student interviews were conducted to find perceptions of how students felt about vocabulary activities in science, their own abilities in science, and to evaluate if they were able to answer some vocabulary questions over words used in the content from throughout the year correctly. These interviews were also conducted to see if there were any trends within the student's answers. There were a couple themes that were found within student responses during the interviews, as many of the students answered when asked "if they were to list all the students in the class from worst to best in science, where would you put yourself?" many of them did not believe they were doing as well as what they actually were in science. In fact, four of the seven students said they believed they were in the middle of the class, when in actuality, these students were all towards the top of the class. When asked how good they were at science, most of the students considered themselves good at science, but not great. But when looking at how these students scored on the NWEA MAP Science Growth test, six of the seven participants scored on, or above grade level.

Summary

The purpose of this study is to investigate: How does the use of pre-teaching of science vocabulary with the use of a KIM chart and the use of technology to use and review these words impact with overall understanding within science content for sixth grade students. An identical pre- and post-test over vocabulary words was taken and grades were recorded. A content test was also given at the end of each content area.

Students also took a standardized test over general content information and their scores were evaluated as to where they scored in comparison to expectations. This test was taken in the fall, for a baseline score, in the winter and in the spring.

Students were also interviewed to find their feelings about science, how they felt they performed in class and out of class personally, and in comparison to other students within their class. They were also asked questions about 4 science vocabulary words used in context, that were used within the school science content. They were to identify if the word was used correctly or not, and if not, how would they change the meaning to make the sentence correct.

CHAPTER 4: FINDINGS

Overview

In doing this research, I was able to find that within the seven students that had consented to this project, growth was seen in the percentage of change between pre-test and post-test scores on vocabulary tests. This came from the use of pre-teaching of vocabulary words with the use of a KIM chart and the use of technology to study words throughout the time of the content being taught. These activities were seen as being beneficial by the students as when asked, “Do you like the vocabulary activities more or less than other activities we do?”, they responded with answers like, “More, because it is fun and it’s not boring.”, and “Yes, Quizizz. Because if you get the answer wrong, it will tell you the correct answer, and you can learn from that.” When asked “If I do this investigation to see how students learn vocabulary again, what might I do to make it easier for you to learn the vocabulary?” suggestions given were “ Diagrams that show how it is used, instead of just giving the definition, why is that the definition.” And to “Use more pictures when introducing the words, as well as more context practice.”

One interesting theme that come up during student interviews was the fact of where the students saw themselves and their success or failure in the classroom in the realm of science. Many of the students stated that they felt they were in the middle of the class as far as science knowledge, when in fact six of the seven were at the top of the class, and many of them scored above grade level when taking the NWEA Map Science growth test.

Throughout the study, some themes that reoccurred in teacher field journal, when reflecting on “How does each of the two incidents I wrote about relate to how does the

use of pre-teaching and technology increase student learning?" was how students that were reluctant to answer vocabulary questions, were starting to answer with confidence. And students, even those that struggle, are seeing success as they work through Quizizz and are the ones being successful in the tournaments and when Quizlet Live is used. An observation that I made throughout the study, was just how much the students were using the vocabulary words in class, and understanding how to the use words correctly in context.

Student Vocabulary and Content Test Scores

Student 1 had two tests where they demonstrated a prior knowledge of the vocabulary words and there was no change between their pre-test and post-test scores. But as can be seen, there was quite a bit of change between pre- and post-test scores on the other 4 tests. They had mixed results on the content test.

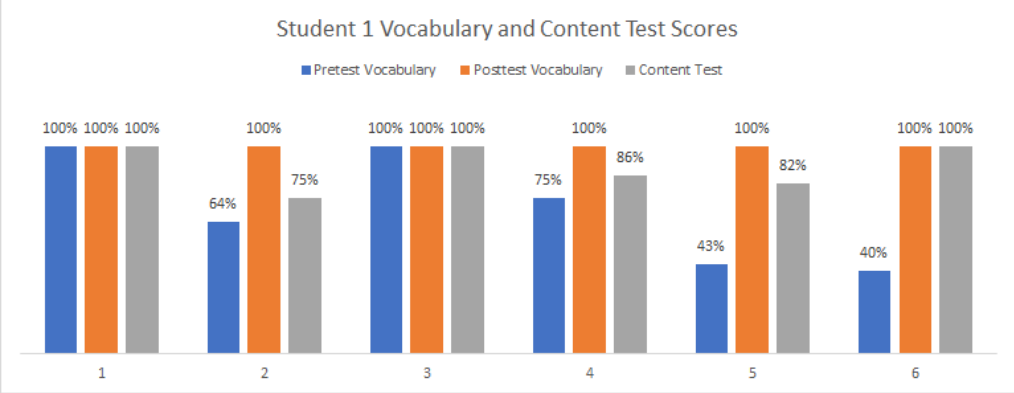

Figure 1. Vocabulary and content test scores for Student 1.

Student 2 had one pre-test that was not taken, so change cannot be seen on that test and there was one test where there was no change between the pre- and post-test scores demonstrating their prior knowledge of the vocabulary words covered. Student was also

very successful in completing of content tests correctly, showing some carry over of knowledge and understanding of the vocabulary within the content.

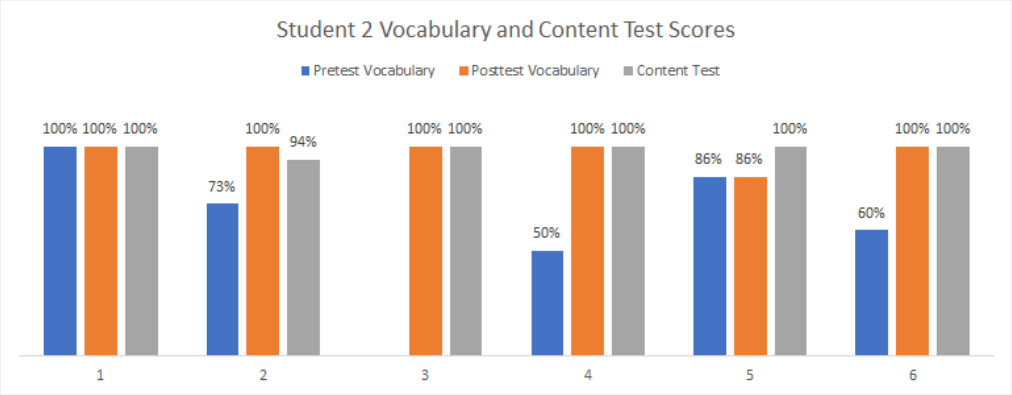

Figure 2. Vocabulary and content test scores for Student 2.

Student 3, as can be seen had little prior knowledge of vocabulary words that were introduced, but with practice and the use of the words within the content, was very successful at learning the vocabulary. They were also generally successful at content tests, showing the vocabulary knowledge carried over.

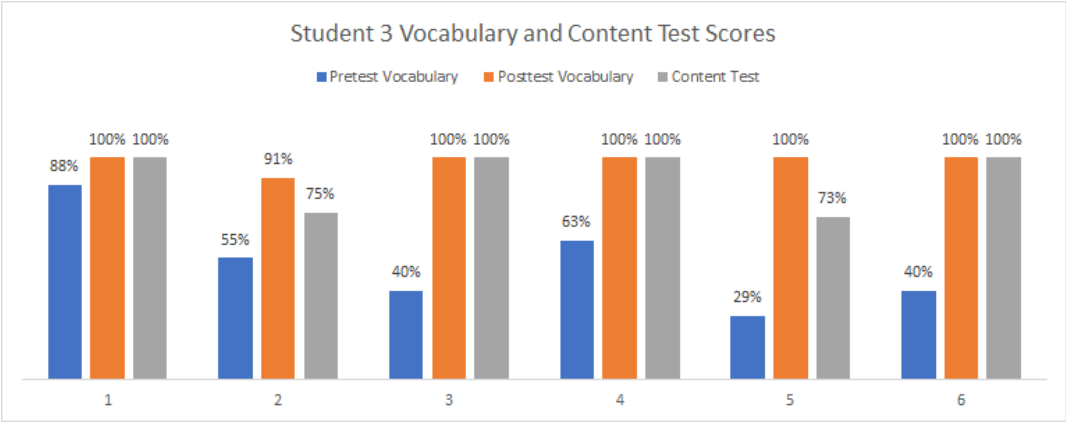

Figure 3. Vocabulary and content test scores for Student 3.

Student 4 had some prior knowledge of the vocabulary words that were introduced. Student was very successful in the taking of post-tests after using technology to practice vocabulary words and their meanings. This also translated into much success on the content tests.

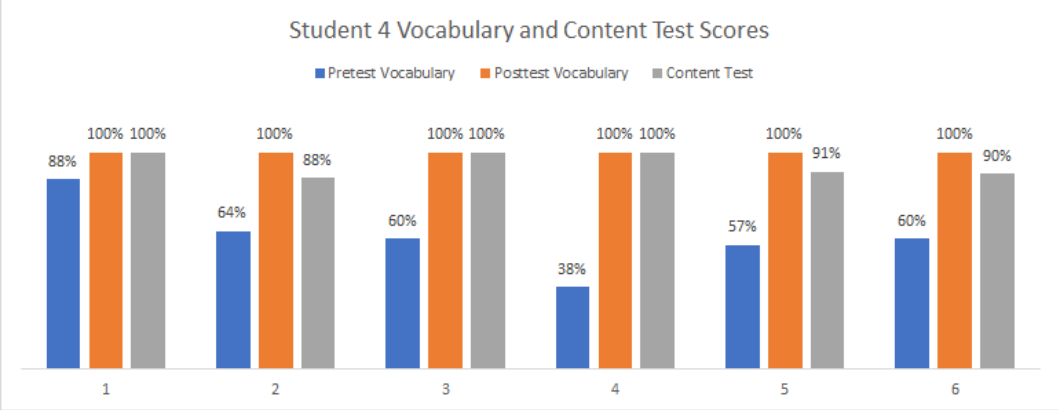

Figure 4. Vocabulary and content test scores for Student 4.

Student 5 had varied amounts of prior knowledge of the vocabulary words that were introduced. With the use of technology for practice, this student was very successful on post-test vocabulary words. But this success on the vocabulary test, did not always translate into success on the content test.

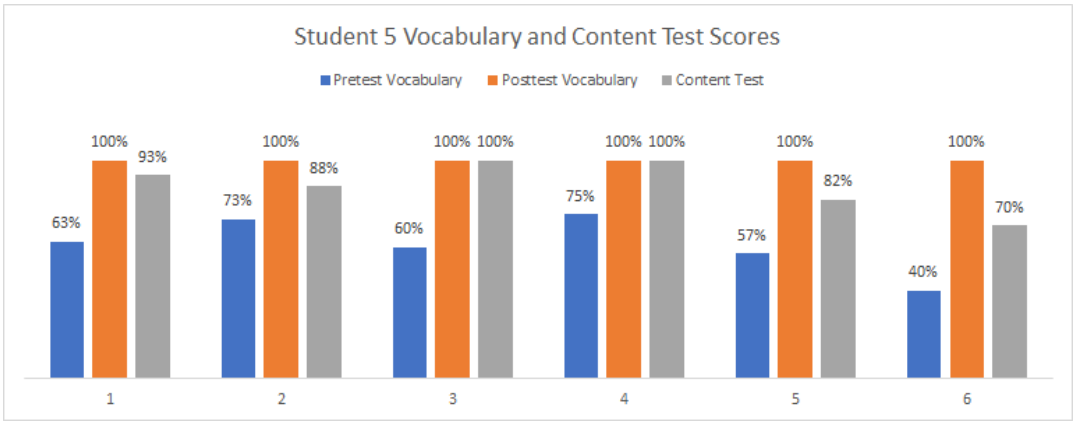

Figure 5. Vocabulary and content test scores for Student 5.

Student 6 had one pre-test that was not taken, so change cannot be seen on that test. This student also had quite a bit of prior knowledge of the vocabulary words introduced, but also showed success in the use of technology for practice as they received perfect scores on all post-tests and this knowledge also carried over to the content tests.

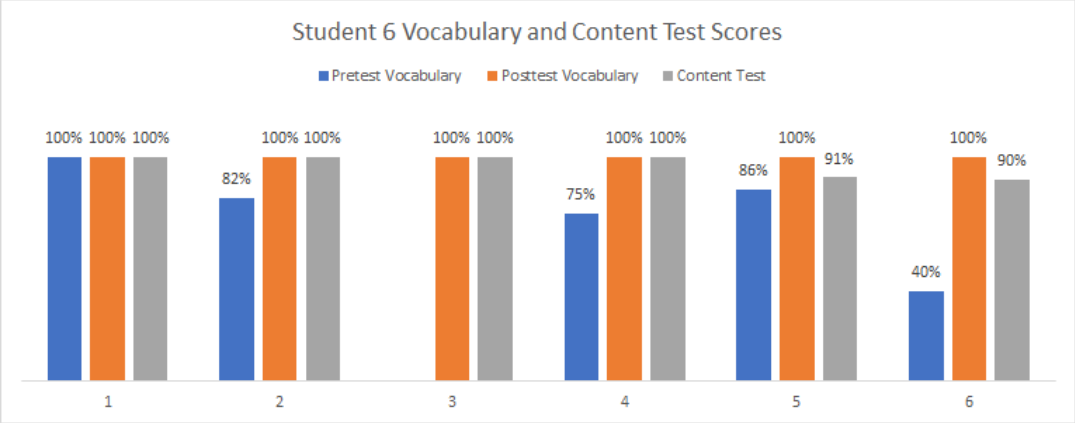

Figure 6. Vocabulary and content test scores for Student 6.

Student 7 had one pre-test that was not taken, so change cannot be seen on that test. This student had varying ranges of prior knowledge with vocabulary words that were introduced and discussed with the content. Student 7 was quite successful with the use of technology to practice the vocabulary words with meanings. The majority of the time, this success was also carried through the content tests as well.

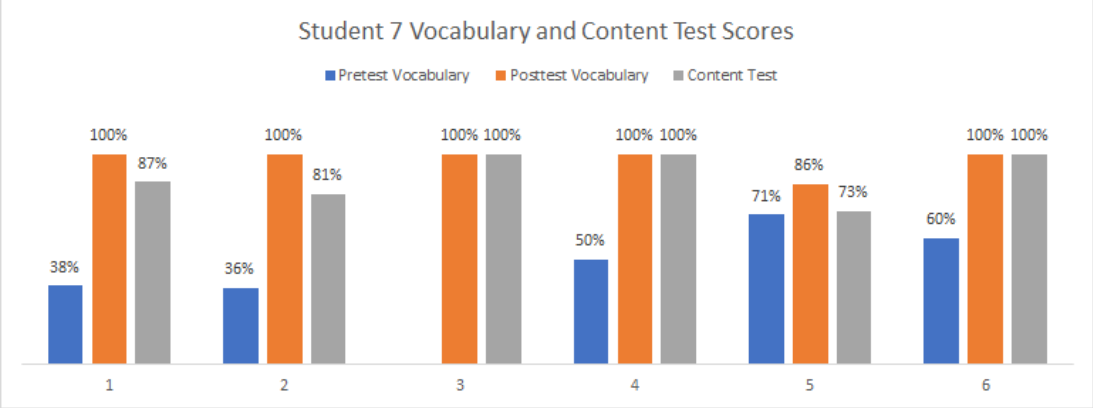

Figure 7. Vocabulary and content test scores for Student 7.

Student NWEA MAP Science Growth Test Scores

There was quite a bit of difference between the students and how they did on their NWEA MAP Science Growth test. Some students, such as Students 7 and 2, saw a lot of growth, while others saw minimal growth, Student 1. Some saw a large jump between fall and winter, Student 3, and then dropped between winter and spring. Student 3 told me during the interview, when asked about the vocabulary activities, that they "Like them less than other activities. I liked them at the beginning, just not at the end." Which could be a contributing factor to the drop during the spring semester. Another contributing factor to this may be due to time constraints because of the many days that we were off of school because of inclement weather and days that were allotted for state testing. During the spring semester, students were not given the same amount of time to use Quizizz.com to review all of the vocabulary words like what had been given before they took the winter test.

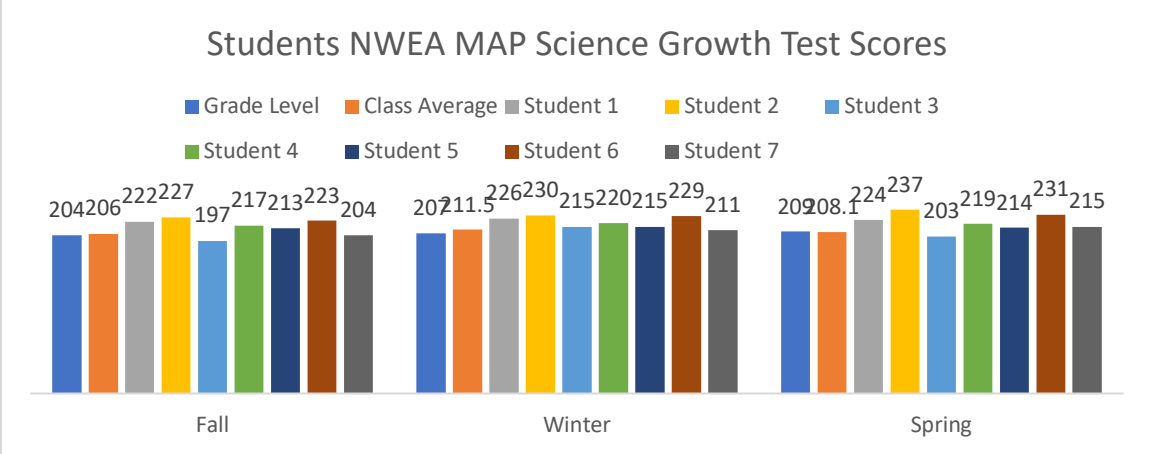

Figure 8. Participating students NWEA MAPs Science growth test scores along with expected grade level scores and class average.

Table 3

NWEA measure of academic progress science growth test data for participants showing effect size of change

Student	**Fall Score**	**Spring Score**	**Effect Change**
Student 7	204	215	+11
Student 2	227	237	+10
Student 6	223	231	+8
Student 3	197	203	+6
Grade Level	204	209	+5
Class Average	206	208.1	+2.1
Student 4	217	219	+2
Student 1	222	224	+2
Student 5	213	214	+1
Total Average Growth of Group			**+5.71**

Source: Participating students NWEA MAPs Science Growth Test Results

In looking at the table on the previous page, it can be seen that Student 7 and Student 3 both scored below or at the expected RIT score of what was expected of sixth graders taking the NWEA MAP Science Growth test in the fall. Throughout the year, these students showed the most growth between their vocabulary pre- and post-tests as well as being two of the four students that showed growth greater than expected on the NWEA Science test. Therefore, showing that the use of pre-teaching and technology for exposure, practice, and review can help students that struggle with science content and vocabulary knowledge.

The table also shows that the results are mixed for those that score above the expected RIT score for sixth grade fall testing on the NWEA Science test. This is evident when looking at Student 2 and Student 6's results who show greater than expected growth on the NWEA Science test and who also show success between the vocabulary pre-and post-testing, but Students 4, 1, and 5 show less than expected growth on the NWEA Science test, although showing success between the vocabulary pre- and post-tests.

Summary

In doing this research, the researcher was able to find that within the seven students that had consented to this project, growth was seen in the percentage of change between pre-test and post-test scores on vocabulary tests. This came from the use of pre-teaching of vocabulary words with the use of a KIM chart and the use of technology to study words throughout the time of the content being taught. These activities were seen as being beneficial by the students as when asked, "Do you like the vocabulary activities more or less than other activities we do?", they responded with answers like, "More,

because it is fun and it's not boring.", and "Yes, Quizizz. Because if you get the answer wrong, it will tell you the correct answer, and you can learn from that.". And when asked "If I do this investigation to see how students learn vocabulary again, what might I do to make it easier for you to learn the vocabulary?" suggestions given were " Diagrams that show how it is used, instead of just giving the definition, why is that the definition." And to "Use more pictures when introducing the words, as well as more context practice." Growth was seen by all the students in the amount of change from vocabulary pre-tests to post-tests. With many of the students, this growth with the vocabulary was also seen in their success when completing content tests as well.

Growth was also seen amongst the results of participating students' NWEA MAP tests. This growth was not nearly as consistent as what the vocabulary tests showed. Many of the students were scoring above grade level by significant amounts before the research began and thus makes it harder to see larger amounts of growth. Students 3 and 7 did show signs of the most benefit of when looking at vocabulary pre- and post-tests and on the NWEA MAP Science test they scored below or at grade level in the fall and they were two of the four that made the greatest growth in the spring.

CHAPTER 5: DISCUSSION AND CONCLUSIONS

Overview

With vocabulary being one of the starting points or *meat and potatoes* of learning specifically content that is taught most times in a lecture type setting, it is important that students are introduced early in the content information to the words that they will be using. Students should also be given as many opportunities to use these words as possible, whether it be in class discussions or the use of technology to receive and practice recognizing the definitions to the words. Many times, within science, words that are used either have different meanings than the way that it is used in everyday life, or it is a very complex definition, that students have not been exposed to. It is of great importance that students can be exposed to the words as often as possible.

This can be done through the pre-teaching of the vocabulary early in the content, and then through the use of technology for the students to practice the words in context or matching the words to their definitions.

Discussion

The use of vocabulary pre-teaching strategies as well as the use of technology in the classroom are some ways to increase students' knowledge of pertinent vocabulary and allows them to better understand concepts. Rupley and Slough (2010) found that essential capabilities necessary for understanding informational texts are prior knowledge to connect with what is read and learned, vocabulary knowledge to understand the concept laden words that are esoteric to the subject, and metacognitive skills to monitor learning. Young (2005) also found that students' first requirement for understanding what they read in science is to understand the language (i.e., vocabulary of the content) within text

and classroom instruction in which their science material is presented. Students' level of understanding concerning their science vocabulary is an excellent predictor of their ability to understand science text. By using prior knowledge and building background knowledge, this facilitates students' comprehension of science text, vocabulary, and key concepts (Young, 2005). What was demonstrated, especially in the date from the vocabulary pre-test and post-test and the content tests is exactly what is being shared by Young, Ripley, and Slough. And it makes sense. Without a knowledge of the words that will be used within the content, how will the students understand what the content itself is about. If the teacher is talking about making a hypothesis, the students need to know what a hypothesis is before they can understand how to make one.

For students to acquire the new terms, like hypothesis, repeated exposure is needed in meaningful contexts. Such context would be such as those provided in a language or word-rich environment, where students are given the opportunity to read, hear, use, and talk about new vocabulary that they have learned, and the opportunities are many and varied (Blachowicz, Fisher, Ogle, & Watts-Taffe, 2006). This is done, so that connections can be made to prior knowledge and experiences, and can be accomplished through the pre-teaching, explicitly teaching of vocabulary, before lessons or activities (McGlynn & Kozlowski, 2017).

One way that connections can be made is through the use of technology to in a sense create drill and practice opportunities for students, that keep them motivated to continue to work to learn what the words mean. In using technology, the students receive instant feedback, and also can look at what the correct answer should be if they were to

miss a question. This success was seen in the amount of growth that was shown between the pre- and post-tests that students took over the vocabulary words.

Conclusions

One major point that is shown through this study is the importance of students learning, constantly using, and being exposed to vocabulary words. Gone are the days when we talk about vocabulary for one day, expecting students to know what the words mean, and then we move onto the next thing. For students to be successful in using the words that they are learning, they need to be given different ways that they can work with the vocabulary and technology lends to that thinking. Whether it be using it to look up the definition to a word, using a program to review the word and its meaning, or a program where the student is able to hear the word and use it in context in various ways, technology gives us that opportunity.

It is of great importance that no matter what subject area is being taught, it is a must to pre-teach the vocabulary and give students many opportunities to use and hear it.

Limitations

One limitation that occurred during this study was that there was a hope that there would be a wider range of academic abilities of students that would consent to the study. Many of the students that consented were students that were towards the top of the class academically and were conscientious about their grades. This made it hard to show how this would affect students of different academic levels, like those receiving Special Education services and those that are in the ELL program.

The weather was another limiting factor. There were many days where school was cancelled due to inclement weather, thus causing a break in review and instruction, which may have had some effect on the results.

Lack of access to internet for some students was another limitation. Although much time was spent in class reviewing, it may have also been beneficial for students to have access to Quizizz.com at home so that they could review on their own as well, considering the amount of days of school that were missed due to inclement weather.

Also, having 27 students in this class for most of the time of the research project lent to be a challenge at times, to get to those students participating to see how many times it took them to master Quizizz and be able to move on, as well as to maybe talk to them about the vocabulary words more in depth.

Future Research

Much of the research that was found was based mainly on pre-teaching of vocabulary within the scope of the subject area of reading or Language Arts, and just the use of technology within the classroom in general. There needs to be more research based solely looking at the effect of pre-teaching science vocabulary words and how that affects the learning of all students, especially those that tend to struggle in school. It would be helpful to do a study where students are given a certain amount of times to do a program and see if that effects their overall learning, rather than giving them the opportunity to continually review the words. It would be interesting to see if these students were given a cumulative test over all of the vocabulary words for that semester, at the end of the semester, to see how many words they have truly learned and how many they just memorized for the post-test.

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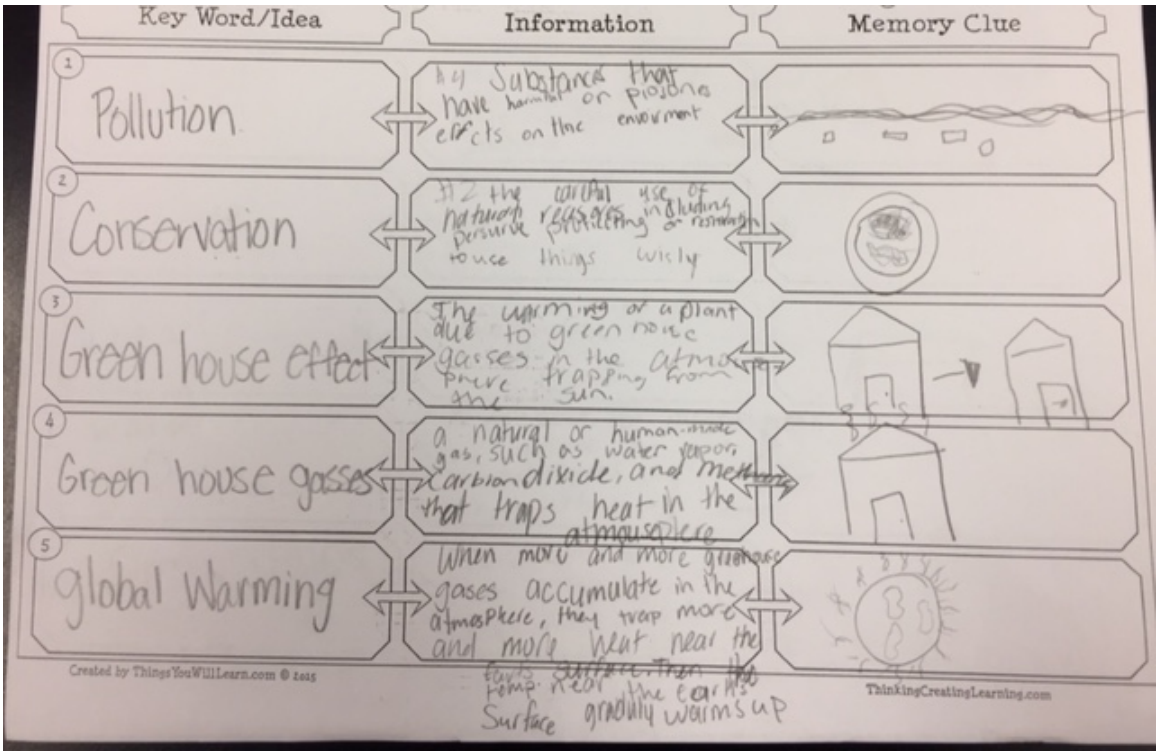
APPENDIX A: Key word/idea, Information/definition, Memory Clue (KIM)Chart

Example and Sample Student Work Using the Chart

KeyWords/ Ideas	Information/ Definition	Memory Clues


Key Word/Idea
Information
Memory Clue
1
Pollution
Substances that have harmful or poisons effects on the enviorment
2
Conservation
the careful use of natural resources in limiting pressure protecting or restoring to use things wisely
3
Green house effect
The warming of a plant due to green house gasses in the atmosphere trapping from the sun.
4
Green house gasses
a natural or human-made gas, such as water vapor, carbon dioxide, and methane that traps heat in the atmosphere
5
global Warming
When more and more greenhouse gases accumulate in the atmosphere, they trap more and more heat near the earths surface. Then the temp near the earths surface gradually warms up
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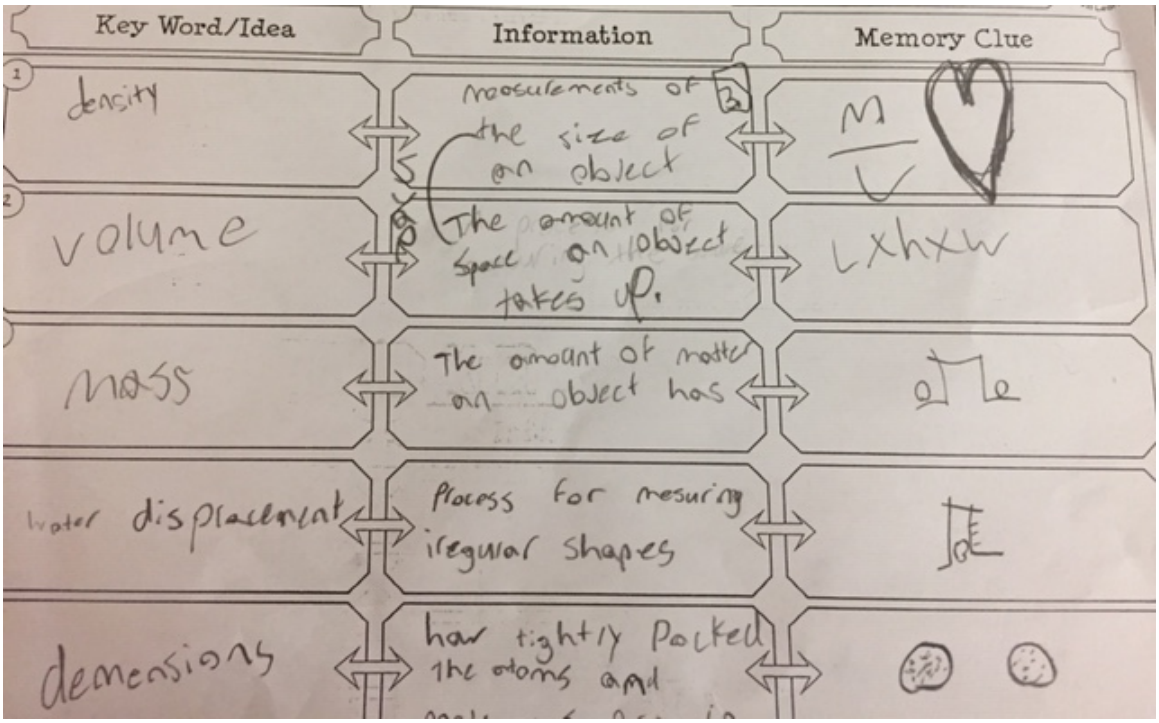
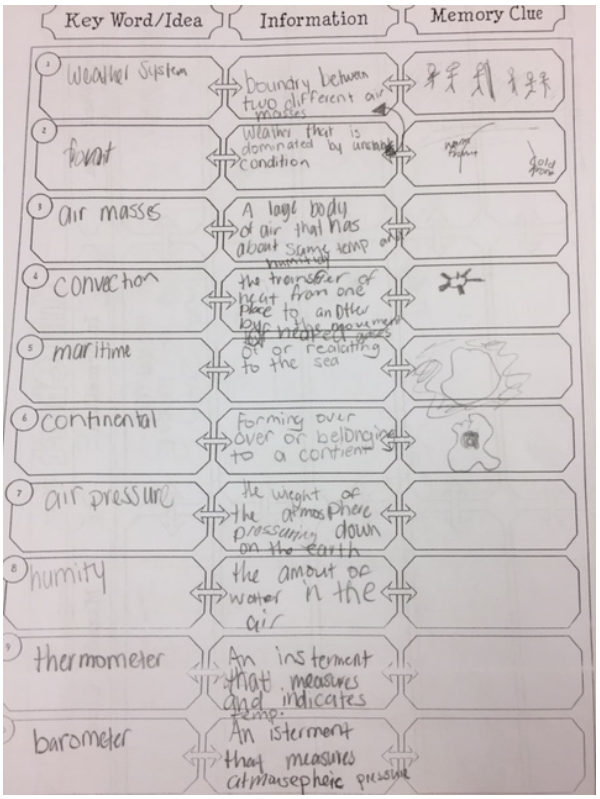
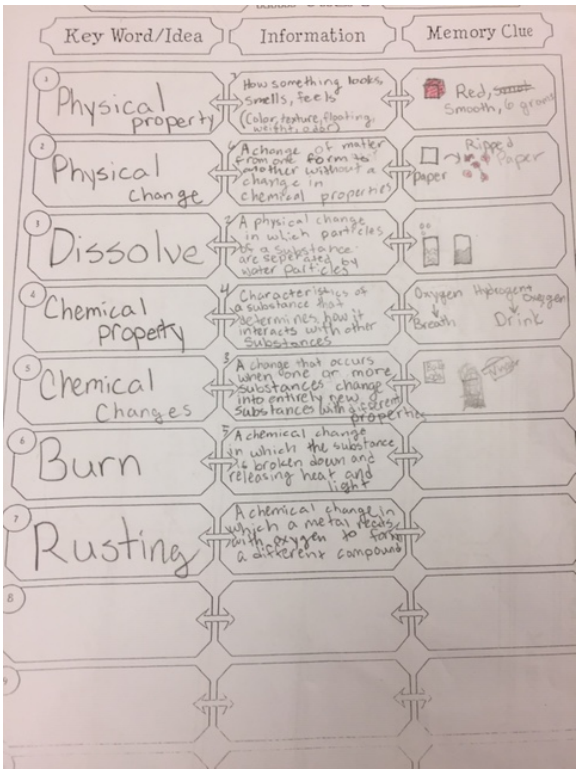
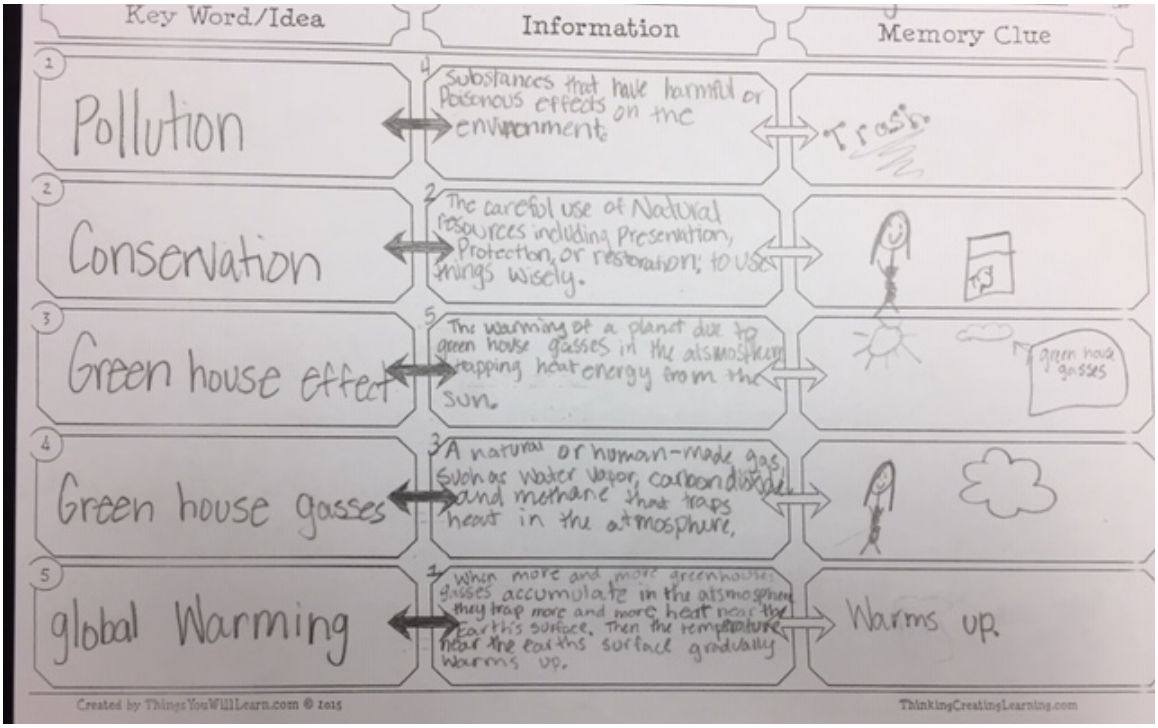

Key Word/Idea
Information
Memory Clue
1
density
measurements of the size of an object
M/V
2
volume
The amount of space an object takes up.
LxhxW
mass
The amount of matter an object has
water displacement
Process for mesuring irregular shapes
demensions
how tightly Packed the atoms and



Key Word/Idea	Information	Memory Clue
1 Weather System	Boundry between two different air masses	
2 front	Weather that is dominated by one condition	
3 air masses	A large body of air that has about same temp and	
4 convection	the transfer of heat from one place to another by the movement of or realating to the sea	
5 maritime		
6 continental	forming over or belonging to a continent	
7 air pressure	the weight of the atmosphere pressuring down on the earth	
8 humity	the amout of water in the air	
9 thermometer	An instrument that measures and indicates temp.	
10 barometer	An istermment that measures atmasephere pressure	



Key Word/Idea	Information	Memory Clue
1 Physical property	How something looks, smells, feels (Color, texture, floating, weither, odor)	Red, ~~smell~~ Smooth, to ground
2 Physical change	A change of matter from one form to another without a change in chemical properties	Ripped Paper
3 Dissolve	A physical change in which particles of a substance are seperated by water particles	
4 Chemical property	Characteristics of a substance that determines how it interacts with other substances	Oxygen Hydrogen Oxygen Breath Drink
5 Chemical Changes	A change that occurs when one or more substances change into entirely new substances with different properties	
6 Burn	A chemical change in which the substance is broken down and releasing heat and light	
7 Rusting	A chemical change in which a metal reacts with oxygen to form a different compound	
8		
9		



Key Word/Idea	Information	Memory Clue
1 Pollution	4 Substances that have harmful or Poisonous effects on the environment.	Trash
2 Conservation	2 The careful use of Natural resources including Preservation, Protection, or restoration; to use things wisely.	
3 Green house effect	5 The warming of a planet due to green house gasses in the atsmosphere trapping heat energy from the sun.	green house gasses
4 Green house gasses	3 A natural or human-made gas such as water vapor, carbon dioxide and methane that traps heat in the atmosphere.	
5 global Warming	1 When more and more greenhouse gasses accumulate in the atsmosphere they trap more and more heat near the Earths surface. Then the temperature near the earths surface gradually warms up.	Warms up.

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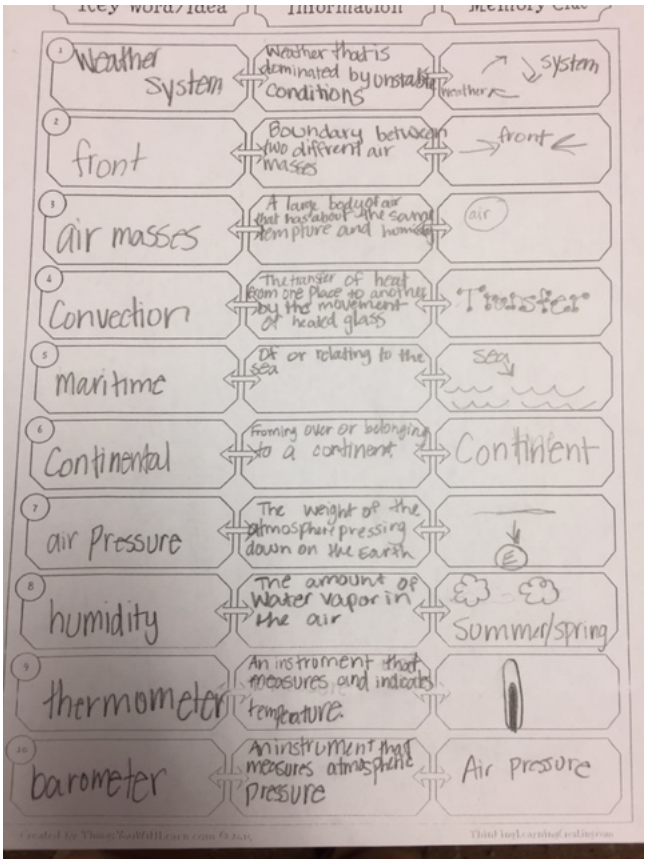

Key Word/Idea	Information	
1 Weather System	Weather that is dominated by unstable conditions	system weather
2 front	Boundary between two different air masses	front
3 air masses	A large body of air that has about the same temperature and humidity	air
4 Convection	The transfer of heat from one place to another by the movement of heated glass	Transfer
5 maritime	Of or relating to the sea	sea
6 Continental	Forming over or belonging to a continent	Continent
7 air Pressure	The weight of the atmosphere pressing down on the Earth	
8 humidity	The amount of water vapor in the air	Summer/spring
9 thermometer	An instrument that measures and indicates temperature.	
10 barometer	An instrument that measures atmosphere pressure	Air Pressure

APPENDIX B: Student Interview Questions

Student Interview Questions

Student interviews will be focused on a subset of these questions.

1. Do you like the vocabulary activities more or less than other activities we do? Why?
2. What kind of job do you want to have when you grow up?
3. How successful do you feel about using science skills in and out of class? Give an example of how you use science outside of class.
4. How good are you in science?
5. If you were to list all the students in our class from worst to best in science, where would you put yourself?
6. Compared to other school subjects, how good are you are science?
7. Why is it important to know the meanings of vocabulary words you see in science?
8. Are some of the words we use in science confusing?
9. Why do you think these words are confusing?
10. If I do this investigation to see how students learn vocabulary again, what might I do to make it easier for you to learn the vocabulary?
11. Is there anything you want to know from me?
12. Is there anything else I should know about you to better understand your attitudes toward science or your science experiences in general?
13. I'm going to read a few sentences to you. After each sentence, please tell me yes, I used the term correctly or no, I did not use the term correctly.
    1. An organ is a group of cells that do the same job. (no) If student answers no, ask what part is wrong and what word will fix it? (cells, tissues)
    2. Producers are organisms that make their own food. (yes) If student answers no, ask what part is wrong and what word will fix it?
    3. Erosion is movement of Earth materials by water, wind, or ice. (yes) If student answers no, ask what part is wrong and what word will fix it?
    4. A proton is a neutral subatomic particle located inside of the nucleus. (no) If student answers no, ask what part is wrong and what word will fix it? (neutral, positively charged)

APPENDIX C: Teacher Field Journal Questions Considered

Teacher Personal Journal for Action Research

Reflection Questions:
Reflecting on students' use of science vocabulary words pre-taught and showing understanding of content being covered at the time.

1. How does each of the two incidents I wrote about relate to how does the use of pre-teaching and technology increase student learning in science?

2. What changes have I seen in my students this week? ie. How have my students results on Quizizz.com or Quizlet.com increased during the week? How many times are they having to play each day before getting 100% accuracy on two games? What students have I seen start using the vocabulary words correctly in class, that maybe weren't earlier in the week.

3. What surprised me this week, related to students' use of weekly vocabulary words?

4. What went really well this week, related to students' understanding of science content in relation to vocabulary words dealing with this content?

5. What challenges did I encounter this week related to my research? What did I do to address these challenges?

6. What did I learn this week that will inform my teaching and/or journaling next week?

7. Tensions I felt this week between my roles as teacher & researcher: