Examination of the Effectiveness of Vocabulary Journals in Science

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Abstract

In science, content-specific vocabulary words are tied directly to the main concepts being taught. It is important for teachers to recognize this, and address it, since comprehending the text is key to success. This study addresses the need to help students understand the meaning of new words as they are introduced in science. An understanding of vocabulary terms is critical for understanding the overall concepts of texts, communicating ideas and avoiding misunderstandings. Specifically teaching vocabulary helps to deepen the meaning of texts. This study examines a strategy for teaching science vocabulary words that will help students understand the meanings of new terms. The purpose of the study is to explicitly teach words essential to the understanding of science concepts by using vocabulary journals, and then examining the effectiveness of this method to help students learn new words in science. There are two main research questions that guide this study; one, does the use of vocabulary journals increase students' understanding of new science words?, two, does journaling help students to define and correctly use new vocabulary words? The results of this study indicate that using vocabulary journals is an effective strategy to help students understand new words in science. The results also show that the journals are effective in helping students to define and use new vocabulary words.

Keywords: science concepts, vocabulary, journals

Examination of the Effectiveness of Vocabulary Journals in Science

In many content areas, a large part of instruction comes from reading various texts. In some areas, especially science, content-specific vocabulary words are tied directly to the main concepts being taught. Teachers regularly use specific vocabulary words in instruction as well as discussion, but if students do not understand those words, they will be confused. It is important for teachers to recognize this, and address it, since comprehending the text is key to success in any content area (Wood, Harmon, & Taylor, 2011). This study addresses the need to help students understand the meaning of new words.

Teachers also expect students to use accurate vocabulary when discussing concepts in class instead of glossing over words, using vague words, or incorrect words. Vocabulary is something that needs to be taught explicitly (Greenwood, 2010), and is critical for communicating ideas and avoiding misunderstandings in any subject area (Rubenstein, 2007). Specifically teaching vocabulary helps to deepen the meaning of texts (Pierce & Fontaine, 2009) and allow for rich discussion. This study uses a strategy for explicitly teaching science vocabulary words to increase students' understanding of new words which will lead to more accurate communication in the classroom and will deepen the meaning of the text.

Students need to know the best way to share their ideas and demonstrate understanding of the subject being taught. Students will be better able to contribute to class discussions if they understand what is being said or asked of them, and having a greater vocabulary will allow students to ask more meaningful questions. This study attempts to help students demonstrate their understanding of the vocabulary of science.

The purpose of the study is to explicitly teach words essential to the understanding of science concepts by using vocabulary journals, and then examining the effectiveness of this method to help students learn new words in science. Words essential to the understanding of the

concepts being taught will be introduced in context and then their meanings will be taught explicitly so that the words will become part of their working vocabularies.

The study hypothesizes that:

1. The vocabulary journals will be effective in helping students learn the meanings of new words that are critical to understanding science concepts. Hearing and seeing the words in context first and then being given specific instruction in the meaning of the words will help the students make sense of these new words.
2. The students will be able to demonstrate knowledge of the new vocabulary words on a posttest. Students will gain new understanding of the words by seeing, hearing, and then writing the meanings of words in their journals where they will also write similar words, a sentence and add a picture. They will be able to use the words correctly in class which will give them even more confidence when demonstrating their knowledge on the test.

The two main research questions guiding this study are: 1. Does the use of vocabulary journals increase students' understanding of new science words? 2. Does journaling help students to define and correctly use new vocabulary words?

The following section includes current research on the importance of vocabulary in understanding the content in areas such as science as well as research on the effective teaching of vocabulary.

Importance of Teaching Vocabulary in Content Areas

When teaching any content area, it is important to specifically address vocabulary in instruction. The better vocabulary a student has, the more likely they are to comprehend various texts (Fisher & Frey, 2014). The Common Core State Standards (CCSS, 2010) require students

to acquire and use a range of general academic and domain-specific words and to demonstrate understanding of those vocabulary words.

Learning Standards

With the introduction of more rigorous standards, it is imperative that students gain a larger vocabulary to successfully read texts in science and other subjects, and be able to communicate ideas to others. Students are being asked to determine the meaning of key terms, words and phrases as they are used in scientific or technical texts (CCSS, 2010). When students determine the meaning of new words, they must use that information to evaluate arguments and specific claims in a text, and determine if they are supported by reasons and evidence (CCSS, 2010). Students clearly need to be able to understand the vocabulary they are reading, in order to accomplish these complex tasks.

Students need to be able to communicate ideas using the specific vocabulary encountered in informational texts. When working with others, it is important that students understand one another. The more sophisticated their working vocabulary, the more precise they can be in demonstrating knowledge and communicating their thoughts.

Explicit Teaching

Vocabulary needs to be taught explicitly (Greenwood, 2010), but not in isolation (Fisher & Frey, 2014). Teaching new words needs to flow as naturally as teaching new ideas. Vocabulary is critical for communicating ideas and avoiding misunderstandings in any subject area (Rubenstein, 2007). Students need to share their ideas and demonstrate understanding of the subject being taught. Specifically teaching vocabulary helps to deepen the meaning of texts (Pierce & Fontaine, 2009) and allow for rich discussion. Students will be able to better contribute to class discussions if they understand what is being said or asked of them. It is very

difficult for someone to contribute to a discussion if they spend the entire time trying to figure out the meaning of words that are being used.

Teachers will be able to transition to using higher order thinking questions more often if the vocabulary is not a stumbling block. Comprehension of specialized vocabulary is critical in understanding content area texts (Bryant, Goodwin, Bryant, & Higgins, 2003). Teachers need to be aware of strategies that will help students understand vocabulary, and differentiate instruction based on student needs and ability.

In many content areas, a large part of instruction comes from reading various texts. A teacher cannot assume that all students understand all of the vocabulary they encounter in those texts. In some areas, especially science, content-specific vocabulary words are tied directly to the main concepts being taught. If students do not understand those words, it will be difficult for them to understand the concepts. It is important for teachers to recognize this, and address it, since comprehending the text is key to success in any content area (Wood, Harmon, & Taylor, 2011).

High Stakes Testing

One unfortunate reality of teaching is that students are expected to perform well on high stakes tests and in order to do that students need to have a good working vocabulary. Students are expected to understand texts and answer text dependent questions, and be able to clearly communicate their thinking (Pierce & Fontaine, 2009). Teachers will help their students if they identify words that are often used on high stakes tests and make sure they teach those words. Students will always benefit from learning new words, and the more they know the better they will be able to comprehend the texts they see on high stakes tests.

One such test is the Partnership for Assessment of Readiness for College and Careers (PARCC, 2012). This assessment was created to measure students' ability to apply what they know, rather than memorizing facts. In order to demonstrate an ability to understand and analyze texts, students must have a good vocabulary and be able to comprehend the key ideas in the texts. Students are required to read multiple texts and to write responses to both literary and informational texts that demonstrate their ability to comprehend, analyze, and make comparisons between texts.

Effective Vocabulary Instruction

Because explicitly teaching vocabulary in content areas is so important, it is also important to make that instruction effective. Assuming that students know the meaning of words or can figure it out themselves will not work. Every word is new at some point, and people continue to encounter words that are new to them throughout their lives. Teachers need to expect that students will be exposed to new words in their classes, and be prepared to teach them the meaning of those words in ways that they will remember, and in ways that will enable them to incorporate those words into their own speaking vocabulary.

Repetitive Use of New Words

Students need to encounter new words often in order to truly understand them (Yates, Cuthrell, & Rose, 2011), so repeated use of new words will help students add these words to their permanent vocabulary. Students should be given many opportunities to see and use new words, and collaborate with others (Wood et al., 2011a). Some strategies, such as the use of a word wall, will keep key vocabulary words at the forefront and allow students to see them every day. Teachers can make the most of this strategy, by allowing students to participate in creating

the word wall (Yates et al., 2011). Students take ownership of it and interact with it by using the words regularly.

There is no one best strategy for vocabulary instruction; instead students should have experience with both direct and indirect methods of instruction when learning new words (Putman & Kingsley, 2009). Indirect methods include providing many opportunities for reading or listening to text providing a rich verbal environment.

If students are only given definitions and don't really process the meaning of new words, they will be quickly forgotten. Teachers need to incorporate a wider view of vocabulary development in order to help students retain the meaning of these new words (Wood et al., 2011a) and one of the easiest ways to accomplish this is by using the words often. Teachers need to model what they expect their students to do. When students see and hear the words often, they will begin to use them more frequently (Yates et al., 2011), and new words will become part of their working vocabulary.

As students are learning new vocabulary words, teachers need to support them by providing opportunities to use the new words as often as possible (Greenwood, 2010; Rubenstein, 2007). Telling someone how to do something and then never asking them to do it will not result in real learning, and so telling students the meaning of a new word and then never asking them to use it will not result in true learning of that word.

Making Connections

It is also important for teachers to make connections between new vocabulary words and what the student already knows (Greenwood, 2010). Making a meaningful connection is one way to help cement the meaning of a new word in a student's mind, and is far more beneficial than memorizing a definition. If a teacher views their curriculum as one piece of a larger puzzle,

they may focus on ways to make connections across lessons and units as well as subject areas (Wood, Jones, Stover, & Polly, 2011).

Teachers need to see the importance of the connections between subjects as well as the connections between what is being studied in class and a student's life experiences. The more connections a teacher can make, the more likely the new word will become part of a student's working vocabulary. Middle grade teachers cannot see themselves as specialists who only know one subject area, but instead as teachers who see the connections between subjects and the importance of literacy in all areas in order to best prepare their students (Wood et al., 2011b).

Teaching Strategies

Teachers can help students by anticipating words that will be a challenge to them, and giving students strategies to overcome these challenges (Rubenstein, 2007). Teachers need to choose both general academic words and content-specific words to explicitly teach (Fisher & Frey, 2014). This is particularly important in math or science classrooms where students will encounter content-specific vocabulary that they may not see anywhere else. Some words also have a different meaning in a specific subject like math than they do in everyday English, and this may cause confusion for some students. This challenge needs to be addressed with clear communication and strategies to support students as they learn (Rubenstein, 2007). Teachers need to identify meaningful words that the students should know, and then use research-based instructional strategies to teach those words (Fisher & Frey, 2014; Greenwood, 2010; Pierce & Fontaine, 2009).

There are many strategies that will not only help students learn new vocabulary terms, but will be engaging as well (Yates et al., 2011). Students may also be allowed to have some choice in adding new words to the list of words the teacher has identified as important to know.

In this way, the students are letting the teacher know what words they do not yet understand, and are willing to learn. Having some ownership of their education will help many students retain what they are learning because it is important to them. In areas such as math, students need to acquire specific math language and be able to use it fluently (Rubenstein, 2007). The more teachers are able to model new vocabulary words and allow opportunities for students to use them, the more likely the students are to remember those words long-term (Fisher & Frey, 2014). They will also be better communicators with fewer misunderstandings, and they will be better able to comprehend more difficult texts.

Differentiating instruction. As most teachers know, all students do not learn in the same way or at the same rate. Teachers need to know their students and differentiate their instruction to meet the needs of everyone. Within a classroom, there will also be students with learning disabilities, and teachers face the challenge of identifying methods that will help these students process and understand unknown word meanings (Bryant et al., 2003). Many students with learning disabilities have not spent as much time in wide reading as their peers, so strategies that may work for others such as using context clues, may not be effective for them. Some ideas that may work better would be using memory devices and graphic depictions, having students work in small groups or pairs on vocabulary activities, and multiple exposures to new words over time (Bryant et al., 2003). Learning new vocabulary words through engaging activities is beneficial for all students regardless of their ability or background in reading. Many strategies such as collaborating with others, visually representing new words, and listening to and speaking new words, can be tailored to fit the needs of all students in the room and give them all opportunities to process the meaning of new words (Wood et al., 2011a).

Assessing Vocabulary Instruction

There are many benefits to making sure that students completely understand the meaning of new words, so it is important to make sure that happens in the classroom. Teachers cannot assume that students understand, they must find out. Most teachers support students' learning through scaffolding process.

Assessments to drive instruction. Assessments need to be used to measure vocabulary growth and inform instruction (Stahl & Bravo, 2010). One problem with this is the lack of available assessment tools. If vocabulary is tested at the end of a unit, the results will not help to guide instruction. Since knowing a word involves more than just reciting a definition, assessing vocabulary should involve more than just matching words to definitions. Teachers will have to create their own assessments since most ready-made vocabulary assessments are shallow, and then use them throughout the unit and not just at the end (Stahl & Bravo, 2010).

Some assessments can be made to address different types of knowledge in order to give a better picture of vocabulary understanding. By looking at the areas of recognition, definition, classification or example, context, application, and interrelatedness, teachers can assess the depth of knowledge rather than the breadth (Cervetti, Tilson, Castek, Bravo, & Trainin, 2011). Instead of just asking students to match a word to a definition, students can be asked to use words in context or relate new words to words connected to it and not just synonyms. This helps the teacher see just how well a student really understands the meaning of the word. Most people can easily memorize a word and definition, but you need to truly understand the meaning of the word to use it correctly on your own or make connections to other words.

Research focus. It is not enough to simply state the meaning of a word and move on. That may help for a moment, but students will not remember it. It is also not helpful to ask

students to just memorize definitions of words. There are many beneficial strategies that can be used to help students discover the meanings of new words, and incorporate them into their everyday working vocabularies. In both math and science there are many specific words that students need to know and be able to use correctly.

Students need to be able to discuss ideas and think beyond what is printed on the page, but in order to do that they have to first understand the words they are reading and talking about. If instruction involves teaching the meaning of words in a way that make sense to students, and giving them plenty of opportunities to use their new words, they can use the new words confidently in discussions of concepts and ideas. Taking the time to help students fully understand the specific words related to the content will eventually become a foundation they can continue to build on.

One area that is intriguing and worthy of further study is the use of drawing pictures and keeping a record or journal of new vocabulary terms. This strategy provides a way for students to write down the meaning of new words as well as a connection with another word or idea, and give a visual representation that will help them make a connection in their minds. This strategy may be very helpful in the science classroom where understanding of key words is critical to understanding the overall concepts being taught. Some science words are abstract and using vocabulary journals that include a visual representation of the meaning of the word may go a long way toward helping students make these ideas more concrete.

This strategy would also provide a way of assessing that goes beyond definitions. Students use their examples or connections to help them answer questions or participate in discussions. Using a strategy like this would help drive instruction because the teacher is not waiting until the end of a unit to find out if students understood key terms. The teacher will see

as the unit progresses, what the students understand and what they need more time on, allowing the teacher time to provide extra guidance when it is needed.

Methods

The researcher utilized a quantitative approach to examine the effectiveness of using vocabulary journals in science to increase students' understanding of essential terms. The study was conducted over a six week period during the spring semester of 2017 using a quasi-experimental design. The following describe the participants, setting, research materials, and data collection procedures.

Participants

Participants in this study were purposely selected from the researcher's sixth grade science class at a rural school in East Central Illinois. There were 18 students in the class and all of them participated in the study. The class consisted of students who were 11-12 years old at the time of the study, and there were eight males and ten females in the class. There were no students with IEPs, and no students with major health issues. All students received the same instruction at the same time each day.

Setting

The study was conducted at a rural school in central Illinois with a population of 492 students in grades pre-K through sixth. There were three sixth grade classes with a total of 56 students, and the researcher had 18 students. The study took place during science class which was held every day for 45 minutes. Each student sat at their own desk, and the desks were arranged in groups of three to six. Students received instruction through reading texts, having class discussions, viewing slide shows, asking and answering questions, taking notes, and

creating interactive notebooks. Students all used science vocabulary journals provided by the researcher to record the new vocabulary words.

Data Source, Instruments, and Research Materials

This study used two instruments to collect data for each participant: a pretest/posttest, and weekly progress quizzes. Both of the instruments used were self-developed by the researcher. Participants were also provided vocabulary journals to record the new vocabulary words. While the researcher monitored the use of the journals, they were for the participants' own use, and data was not collected from them. The pretest was administered to all participants prior to any instruction on the vocabulary words to be used in the study. The number of words correctly defined on the pretest was recorded as a beginning score.

Pretest and posttest. The pretest consisted of a variety of question types including matching, multiple choice and fill-in-the-blank (see appendix A). There were 51 questions on the test corresponding to the 51 vocabulary words that were to be introduced over the course of the study. Participants were asked to complete the test by doing their best to fill in the words they knew. They were told that this was a pretest, and that they would take a posttest after receiving instruction on the vocabulary words. They were not given the words in advance. The same test was given at the conclusion of five weeks of intervention as a posttest in order to make a comparison.

Weekly progress quizzes. There were a total of five weekly progress quizzes given (see appendix B). The 51 words were divided up into smaller groups of words to be taught each week. The weekly quizzes were given on Friday of each week to see how the students were progressing with the new words. At the end of the first week the students were quizzed on twelve words. The second week's quiz consisted of eight words, the third week's quiz had ten

words, the fourth week's quiz had ten words, and the fifth week' quiz had eleven words. The format of each quiz was the same. Students were given definitions and had to write the corresponding word.

Vocabulary journals. Each participant was given a vocabulary journal as an intervention tool that was used to record the new vocabulary words (see Appendix C). The journals had enough pages in it so that one word could be recorded on each page. There was a space on the page for the word, its meaning, synonyms, a sentence and a drawing. The researcher told the participants which words to record and then worked with them to develop the meaning to write down, and the synonyms. The participants came up with sentences and drawings that they shared with the class voluntarily. Each participant kept and used his or her own journal for the duration of the study. The researcher monitored the classroom and saw that the journals were being used by each participant, and that each part of the journal was being filled in, but the journals were not collected by the researcher, and no data was collected from them.

Data Collection Procedures

The study took place over the course of six weeks during units on weathering, erosion, fossils and geological time scale. Data collection began early in February 2017 with the administration of the pretest in week one, which was scored and used as a beginning score for later comparison. There were five weeks of intervention using the vocabulary journals.

For the first three days of each week, participants were given two to four selected vocabulary words to record in their journals. They wrote the word, a brief definition, synonyms, a sentence using the word, and drew a picture expressing the meaning of the word. On the second day of each week, the researcher briefly reviewed the previous day's words before addressing the words for that day. On the third day of each week, the researcher briefly

reviewed the words for days one and two before adding the words for that day. On the fourth day of each week, no new words were added, but the words were briefly reviewed. On the last day of each week a quiz was given over the words for that week to determine progress. The quizzes were scored, and the number of words correct was recorded. During the sixth week, the researcher reviewed all 51 of the words one day, and then a posttest identical to the pretest was given at the end of the week and the number of words correct was recorded. Figure 1 shows how the 51 vocabulary words were divided up by week and by day.

Week	**Day 1**	**Day 2**	**Day 3**	**Totals**
Week 1	Bedrock Soil Fertility Soil horizon	Topsoil Subsoil "C" horizon Decomposer	Soil conservation Contour plowing Conservation plowing Crop rotation	12 words
Week 2	Stream River Flood plains	Meanders Oxbow lake Delta	Stalactite Stalagmite	8 words
Week 3	Erosion Deposition Mass wasting	Glacier Continental glacier Valley glacier Plucking	Till Moraine Kettle	10 words
Week 4	Fossils Paleontologist Evolution	Scientific theory Extinct Extrusions Intrusions	Fault Unconformity Index fossils	10 words
Week 5	Radioactive Dating Element Radioactive decay Half-life	Eons Eras Periods Epochs	Invertebrates Amphibians Reptiles	11 words
Total 5				51 words

Figure 1. Schedule of Vocabulary Word Introduction

Data was collected in the researcher's sixth grade classroom. Each participant was assigned a number and all data for that student was associated with their number. The following section explains data analysis and results of the study.

Data Analysis and Results

This section explains how the data was analyzed. This study examined at the effectiveness of using vocabulary journals in science class. Quantitative data was analyzed descriptively to answer the research questions.

Data Analysis

The data from the pretests and the posttests were analyzed quantitatively using Excel spreadsheets. Excel was used to calculate the amount of growth and the percentage of growth for each participant. The data was used to answer the question: Does the use of vocabulary journals increase students' understanding of new science words? The data from the five weekly quizzes was also analyzed quantitatively using Excel spreadsheets. Excel was used to calculate the percent of correct answers for each quiz for each participant, as well as the average percent correct for each quiz for the group, and the average percent overall for each participant. The data was used to answer the question: Does journaling help students to define and correctly use new vocabulary words?

The scores from the pretest and posttest were analyzed to determine if the intervention of science vocabulary journals increased students' understanding of new science words. For each participant, the number of correct vocabulary words they scored on the pretest was compared to the number of correct vocabulary words they scored on the posttest. A positive difference between these two scores would indicate an increase in the number of words correct.

The five weekly progress quizzes were analyzed to determine if the intervention of vocabulary journals helped students define and use new vocabulary words. A score was recorded for each participant by recording the number of correct words on each quiz. Each week the scores for all participants were analyzed, and an average for the group was found. At the end

of the five weeks, the scores of all five quizzes were analyzed and an average score was found for each participant. The following section will discuss the result of the study according to the research questions.

Results

Increased Understanding of New Vocabulary Words.

The use of vocabulary journals increases students' understanding of new science words. Using the vocabulary journals appears to have significantly increased the participants' understanding of new words. The scores from the pretests and posttests revealed that all 18 participants involved in the study improved their scores on the test of 51 new science words. Table 1 shows the pretest and posttest raw scores of all participants.

Table 1

Participant's Scores on Pretest and Posttest n= 18

Participant	Pretest	Posttest
1	15	39
2	24	51
3	25	45
4	20	47
5	17	31
6	16	47
7	12	23
8	24	47
9	18	30
10	12	26
11	11	38

12	20	48
13	18	48
14	11	50
15	18	44
16	21	48
17	8	28
18	20	46

The greatest score increase from pretest to posttest was from participant 14, whose score increased by 39 words. This participant started with a pretest score of only 11 correct, but after five weeks of intervention using the vocabulary journals scored a nearly perfect 50 words on the posttest. The smallest gain was made by participant 7 whose score increased by 11 words. This participant started with a pretest score of 12, and after the intervention scored 23 words correct on the posttest. Even though this is the smallest gain numerically, it is significant because the posttest score is almost double the pretest score. All participants scores were decidedly improved from the pretest to the posttest (see figure 2).

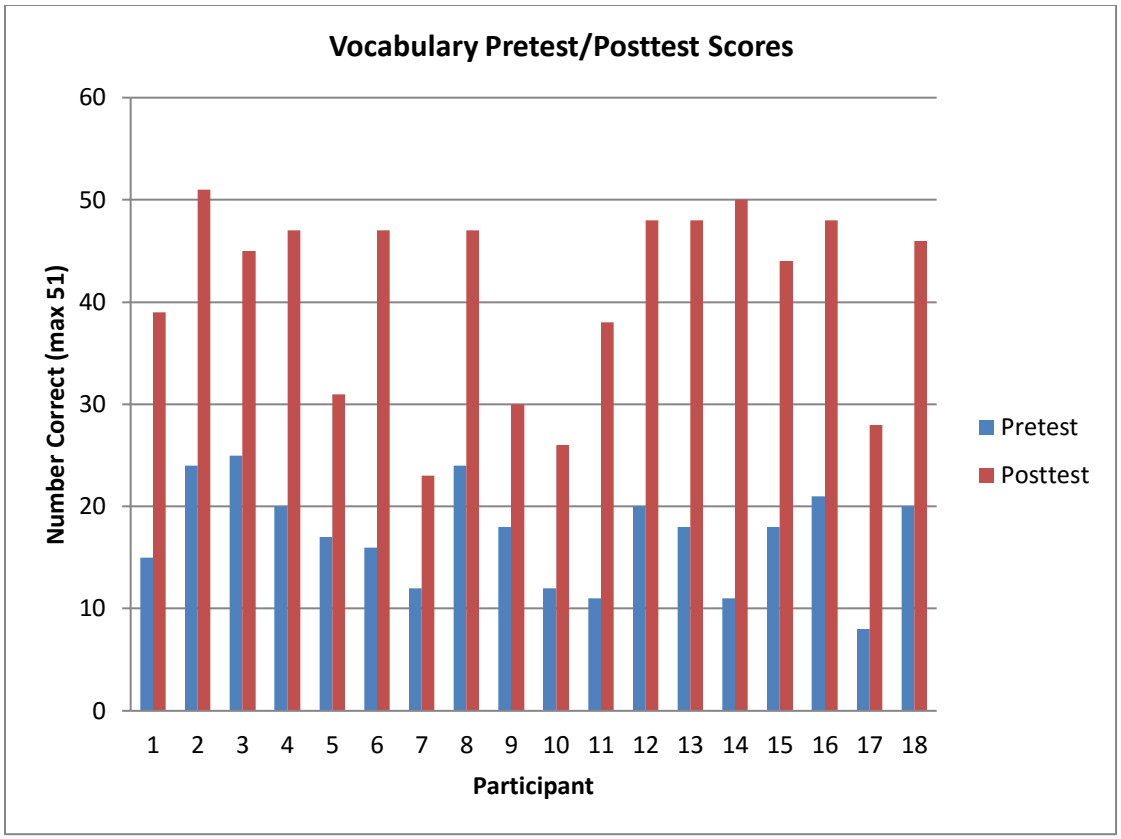

Figure 2: Pretest and posttest scores of all participants showing increase in scores

The average pretest score of the 18 participants was 17.22 words correct out of 51, or 34%. Following the five week intervention, the posttest average score was 40.89 words correct out of 51, or 80%. This is an average increase of 23.67 words or 46%. The participant with the highest increase from pretest to posttest of 39 words, increased by 76% when looking at how many new words were gained of the 51 words introduced. The participant with the smallest increase of 11 words gained 22% more words following the intervention. Table 2 shows the total increase and the average increase in scores for the group as well as each participant.

Table 2

Participants' difference in scores from pretest to posttest n=18

Participant	Pretest Score	Posttest Score	Number Increased	Percent Increased
1	15	39	24	47
2	24	51	27	53
3	25	45	20	39
4	20	47	27	53
5	17	31	14	27
6	16	47	31	61
7	12	23	11	22
8	24	47	23	45
9	18	30	12	24
10	12	26	14	27
11	11	38	27	53
12	20	48	28	55
13	18	48	30	59
14	11	50	39	76
15	18	44	26	51
16	21	48	27	53
17	8	28	20	39
18	20	46	26	51
Average Score	17.22	40.89	23.67	
Average Percent	34	80	46	

Defining and Using New Vocabulary Words.

Using vocabulary journals helped students define and use new vocabulary words. Each week of the five week intervention, each participant was given a progress quiz. Participants demonstrated their ability to define and use new words on these quizzes. A score of at least 70%

correct was used as the criteria to determine if participants were able to define the new words. The mean was calculated for each participant's five average weekly scores on the quizzes. Fourteen out of 18, or 78% of the participants, scored an average of 70% or higher on the five quizzes. In addition, 78% of the participants scored a 70% or above on three or more of the five weekly quizzes. The highest overall average scores were from participants 17 and 7 whose score averages were 97% and 96% respectively.

The average score for the group on the first weekly quiz was 73%, with 10 of the 18 participants scoring 70% or higher. At the end of week two, the average score on the quiz was 81%, with 14 of 18 participants at or above 70%. On week three's quiz the average score was 83%, with 15 of the 18 participants scoring at least 70%. On the fourth weekly quiz the average score was 84%, with 16 of 18 participants receiving a score of at least 70%. At the end of week five, the average score on the weekly quiz was 67%, with 8 participants scoring at least 70%. Four of the five, or 80% of the weekly quiz group averages were above 70%. Table 3 shows the average percentage score for each participant and the average percentage scores for each week for the whole group.

Table 3

Percentage scores of weekly quizzes and mean for each participant and each week n=18

Participant	Average Scores Week 1	Average Scores Week 2	Average Scores Week 3	Average Scores Week 4	Average Scores Week 5	Participant Mean Scores
1	83	75	100	80	55	**79**
2	83	100	100	100	82	**93**
3	83	75	70	100	82	**82**
4	100	100	100	100	64	**93**
5	33	63	80	70	45	**58**
6	100	100	100	100	82	**96**

7	42	13	20	40	45	**32**
8	83	100	80	80	100	**89**
9	67	50	20	70	36	**49**
10	67	75	80	80	64	**73**
11	50	75	100	100	45	**74**
12	58	100	100	80	64	**80**
13	83	100	100	100	82	**93**
14	58	100	100	100	100	**92**
15	100	100	100	100	64	**93**
16	83	100	100	100	100	**97**
17	33	63	40	40	27	**41**
18	100	75	100	70	73	**84**
Group Mean Scores	**73**	**81**	**83**	**84**	**67**	

Findings and Discussion

The overall findings from the study indicate that the use of science vocabulary journals appears to be an effective instructional practice for increasing understanding of new words in science. All participants' scores improved from the pretest at the beginning of the intervention to the posttest at the end of the study. The students not only scored better on the posttest, but they also remembered the meaning of the words when asked in class.

Writing down the word, its meaning, synonyms, a sentence, and drawing a picture for each new vocabulary word put the word in front of the participants often. The more they saw and heard the word and its meaning, the more it seems to have settled in their minds. They were able to demonstrate in class during reviews and on the posttest that they knew the meanings of the words that were being introduced.

This study hypothesized that the vocabulary journals would be effective in helping students learn the meanings of new words that are critical to understanding science concepts and be able to demonstrate that knowledge on a posttest. The results of the study have affirmed this hypothesis. The findings of this study also indicate that the use of vocabulary journals helped students define and use new words in science. Nearly 80% of the participants were able to score 70% or better on the weekly progress quizzes. In addition to the test results, the researcher observed that the participants were able to use the words correctly in class during discussions. Since the participants had to write original sentences using the word in their journals, they had to have an understanding of the meaning and how the word should correctly be used. Drawing a picture gave participants a visual representation of the word which would also contribute to their understanding of the word.

The purpose of the study was to explicitly teach words essential to the understanding of science concepts by using vocabulary journals. Further it examines the effectiveness of this method to help students learn new words in science. The results indicate that the method is effective in helping students understand and use new words.

Limitations

One limitation of this study is the word choice variable. Some words and some definitions are very similar to one another and therefore easily confused. This variable is difficult to control since the words, whether they are similar or not, must be explicitly taught if they are important to the understanding of the science concept being studied. Even though this variable may be difficult to control, every effort should be made to help students understand the new words. A mnemonic device or other memory tool may be used to help students keep from mixing up words. Two of the words in the study, stalagmite and stalactite, are words that are

often confused. The participants were told to think of the letter ‘c’ in the word stalactite as standing for ceiling where they are found, and the letter ‘g’ in stalagmite as standing for ground where they are found. This was very helpful for many students who were then able to keep them straight. Other words in the study had similar definitions, such as eon, era, and period. They are all lengths of time based on fossil records, so it was difficult for the students to remember which one was which. A memory device would have helped here in order to keep students from mixing them up.

Implications and Future Research

Implications

Because the current findings indicate the vocabulary journals are an effective method for helping students learn and use new vocabulary words, science teachers of any grade could consider including vocabulary journals in their instruction. The study was conducted in a science classroom, but because the focus was on learning new words, this method could also be used by teachers in other content areas. Pre-service teachers should also be aware of this effective strategy for explicitly teaching important new vocabulary words.

Parents can also use this valuable intervention when helping their children at home. By having their child write down synonyms and a sentence for each new word they are trying to teach, and draw a picture, the meaning of each word is reinforced. Therefore, the parent will be able to see what their child knows well, and what they are still struggling with.

The researcher plans to continue implementing the use of vocabulary journals in science class because it is an intervention that does not require a lot of extra time, and is very effective in helping students learn and use new words. The expectations for students are more rigorous now that the Common Core State Standards have been implemented, and a greater working

vocabulary is expected of students. By using vocabulary journals, students are improving their vocabularies and learning strategies necessary to be successful and to meet the new expectations.

Future Research

There are some aspects of this study that could be researched further, particularly the way the vocabulary words are explicitly taught in class. Research shows that a person needs to see and hear a new word multiple times before they truly understand it, but how many times? One area to research would be the actual number of times a new word needs to be encountered before it is understood well enough to become part of a person's working vocabulary. To be helpful, the new word needs to be used correctly in context, not just defined, but that can include both what a person sees in writing and what they hear. A comparison could also be made to see whether the written or spoken word has a greater impact, or if a combination of both yields the best results.

Another instructional method that can be researched further is the use of videos to present information. If videos are used inconsistently, there would be no way of knowing what impact they may have on the acquisition of new words. A study could be set up to compare how well students learn new words when viewing videos each day to how well they learn new words without videos.

Reflection and Action Plan

Reflection

Not only did the data collected during the study validate vocabulary journals as an effective instructional strategy for helping students learn the meanings of new words, and helping them define and use new words correctly, but the observations made by the researcher in the classroom confirmed the success of the intervention. Students in the class enjoyed writing in

their journals, and volunteered to read their original sentences aloud. This showed me that they understood the meaning of the word, but it also helped other students who may have been a little slower in coming up with a sentence. They heard how their peers were using the word, and were then able to come up with their own sentence.

The students were also excited to describe their drawings. Some made drawings that looked very much like the word they represented, and others drew pictures that were more of an abstract idea of the word. Each student was proud of their drawings and eager to share them. They seemed to especially like the idea of each person making their own drawing rather than being told what to draw, and coming up with their own sentence. They liked the independent aspect of the journals, and this gave them the opportunity to be an active partner in their learning.

Action Plan

The researcher suggests addressing the limitation of vocabulary choice by trying to find a way to cut down on the confusion created by similar words or similar definitions. If the researcher can teach ways to keep the words from being confused, such as a mnemonic memory device or other memory aid, the effect could be even greater.

The researcher plans to share the finding of the study with colleagues that teach science and other content areas that require learning a lot of new vocabulary words. She also plans to share information about the study with any parents who are interested during individual conferences. The data and findings from the study will also be shared at a poster presentation at Eastern Illinois University. Because the results of the study were so positive, the researcher plans to continue using vocabulary journals as an instructional strategy.

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Appendix A

Pretest **Science Vocabulary** Posttest

Name: _____

Fill in the correct term.

1. _____ Solid layer of rock beneath the soil

2. _____ Breaks down the remains of dead organisms and mixes the soil

3. _____ Flat, wide area of land along a river, often covered with water

4. _____ Formed by deposits in groundwater, hangs from roof of cave

5. _____ The laying down or settling of eroded material

Matching - Write the letter of the correct meaning on the line next to the word.

6. Till _____ a. Ridge formed from till deposited at edge of glaciers

7. Moraine _____ b. Small depression formed when small chunk of ice left in till melts

8. Kettle _____ c. Mixture of sediment deposited directly on the surface

Multiple Choice – Circle the letter of the correct word.

9. Lava that hardens on the surface

a. extinct b. element c. extrusion d. epoch

10. Break in Earth's crust which is always younger than the rock it cuts through

a. fossils b. fault c. erosion d. deposition

11. Measure of how well soil supports plant growth

a. soil horizon b. bedrock c. subsoil d. fertility

Matching

12. Eon _____ a. Based on types of existing life globally at a particular time

13. Era _____ b. Longest subdivisions, based on abundance of fossils

14. Period _____ c. Marked by significant world changes in types of fossils present in rocks

15. Epoch _____ d. Divided periods characterized by differences in life forms

Fill In

16. _____ Layer of soil that differs in color and texture from the layers above and below it

17. _____ Farmers plow their fields along curves of the slope to slow runoff

18. _____ Farmers plant different crops in a field each year

19. _____ Loop-like bend in a river, becomes more curved over time

20. _____ Sediment deposited where a river flows into an ocean or lake

21. _____ Process where forces move sediment from one place to another

22. _____ Large mass of ice that forms on land and moves slowly across Earth's surface

Multiple Choice

23. Gradual change in living things over long periods of time

a. scientific theory b. evolution c. unconformity d. index fossils

24. Well tested concept that explains a wide range of observations

a. evolution b. fossil record c. scientific theory d. radioactive dating

25. Gap in the geological record where some rock layers have been lost because of erosion

a. unconformity b. fossil record c. deposition d. weathering

Fill In

26. _____ One unstable element breaks down into a stable one

27. _____ Time required for half the unstable element to decay

28. _____ Loose mixture of rock particles, minerals, organic material, air, and water

Matching

29. Topsoil _____ a. Crumbly, dark brown mixture of humus, clay and other minerals

30. Subsoil _____ b. Contains partly weathered rock

31. "C" horizon _____ c. Consists of clay and other particles, but little humus

Fill In

32. _____ Management of soil to prevent its destruction

33. _____ Active water channel that erodes land and transports sediment

34. _____ Forms on steep mountain slopes & forms many features as it flows

35. _____Formed by deposits that build up a cone shape on a cave floor

36. _____ Meander that has been cut off, Sediment dammed up the ends

Multiple Choice

37. Downhill movement of a large mass of rocks or soil due to the pull of gravity

a. mass wasting b. erosion c. glaciers d. deposition

38. As a glacier flows over land, it picks up rocks and large boulders, dragging them across land, and leaving gouges and scratches in the bedrock

a. erosion b. plucking c. depositing d. mass wasting

39. Magma that cools and hardens into rock beneath the surface

a. intrusions b. extrusions c. faults d. elements

Fill In

40. _____ A scientist who studies, collects and classifies fossils

41. _____ When an organism no longer exists and never will again

42. _____ Preserved traces of living things, Formed when living things die and are buried by sediment

Matching

43. Invertebrates _____ a. Have dry skin covered with scales/plates, usually lay eggs

44. Amphibians _____ b. Animals that do not have backbones

45. Reptiles _____ c. Live part of life in water and part on land, no scales

Multiple Choice

46. Farmers leave dead leaves and stalks of previous year's crops to return nutrients to the soil, retain moisture and hold the soil in place

a. Contour plowing b. Conservation plowing c. Crop rotation

47. Covers large areas of land and moves outward from central location

a. continental glacier b. mass wasting c. valley glacier

48. Long and narrow, forms when snow and ice build up high in a mountain valley

a. continental glacier b. mass wasting c. valley glacier

49. All the atoms of a particular type of matte are the same

a. element b. extrusion c. fossils d. intrusion

50. Must be widely distributed and represent an organism that existed only briefly, Helps geologists tell relative age of rock layers

a. original fossils b. index fossils c. petrified fossils

51. Geologists use ____dating to determine absolute age of rock

a. radioactive b. conformity c. elemental d. positional

Appendix B

How are we doing?

Vocabulary Quiz 1

Choose the correct word from the word bank for each of the definitions below.

Bedrock	Soil	Fertility	Soil Horizon	Topsoil
Subsoil	"C" Horizon	Decomposer	Soil Conservation	
Contour Plowing	Conservation Plowing	Crop Rotation		

_____ Management of soil to prevent its destruction

_____ Crumbly, dark brown mixture of humus, clay & other materials

_____ Loose mixture of rock particles, minerals, and decayed material

_____ Farmers leave dead leaves and stalks of previous crops

_____ Layer of soil that is different from the layers above and below it

_____ Contains partly weathered rock

_____ Consists of clay and other particles, but little humus

_____ Solid layer of rock under the soil

_____ Farmers plow their fields along curves to slow runoff

_____ Farmers plant different crops in a field each year

_____ They break down the remains of dead organisms

_____ Measure of how well soil supports plant growth

Appendix C

Science Vocabulary Journal

Word

Synonyms

Meaning

Sentence

Picture

Science Vocabulary Journal

Word

Synonyms

Meaning

Sentence

Picture

Appendix D

IRB Certification of Exemption - Collins, #17-017

EIU IRB

Betsy K Collins;
Sham'ah Md-Yunus

January 26, 2017

Elizabeth Collins
EC/ELE/MLE

Thank you for submitting the action research protocol titled, "Examination of the Effectiveness of Vocabulary Journals in Science**"** for review by the Eastern Illinois University Institutional Review Board (IRB). The protocol was reviewed on 1/26/2017 and has been certified that it meets the federal regulations exemption criteria for human subjects research. The protocol has been given the IRB number 17-017. You are approved to proceed with your project.
The classification of this protocol as exempt is valid only for the research activities and subjects described in the above named protocol. IRB policy requires that any proposed changes to this protocol must be reported to, and approved by, the IRB before being implemented. You are also required to inform the IRB immediately of any problems encountered that could adversely affect the health or welfare of the subjects in this study. Please contact me in the event of an emergency. All correspondence should be sent to:

Institutional Review Board
c/o Office of Research and Sponsored Programs
Telephone: 217-581-8576
Fax: 217-581-7181
Email: eiuirb@www.eiu.edu

Thank you for your cooperation, and the best of success with your research.

Cheryl Siddens, Compliance Coordinator
Office of Research and Sponsored Programs
Telephone: 581-8576
Email: casiddens@eiu.edu

Appendix E

January 23, 2017

Dear Institutional Review Board Members,

As principal of Monroe Elementary School in Casey, Illinois, I approve the appropriateness of Betsy Collins's project study titled Examination of the Effectiveness of Vocabulary Journals in Science. Mrs Collins and I discussed the components of the study as well as the expected outcomes. The project is age appropriate as sixth grade teachers work to increase student's working vocabularies, and help students learn how to understand the meaning of new words. Conducting the project at Monroe Elementary School is very feasible and will be completed before the end of the semester. If you have any questions, please feel free to contact me.

Sincerely,

Melissa Meiners

Principal, Monroe Elementary School

Appendix F

January 23, 2017

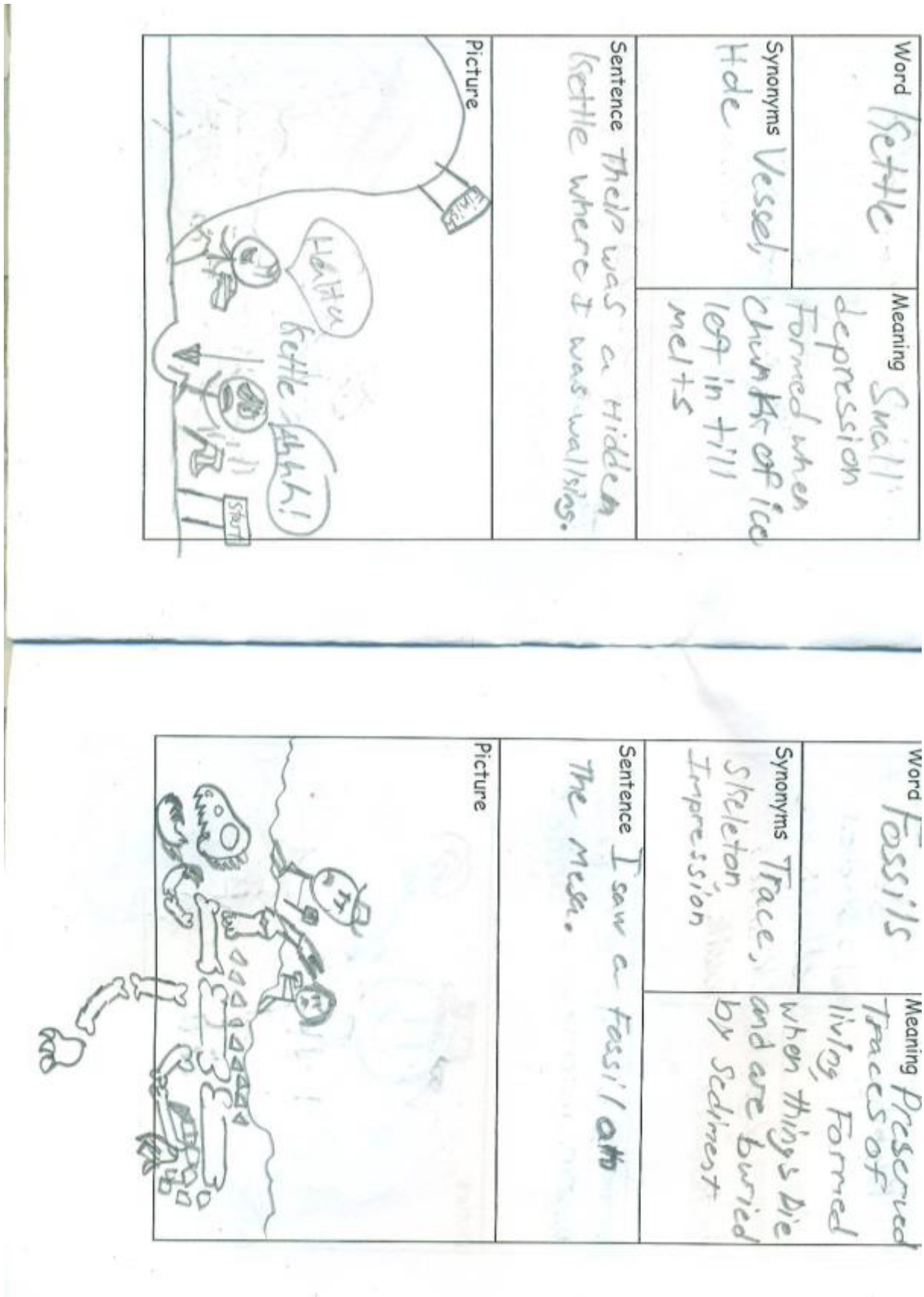
Dear Parents and Guardians,

For the last several years I have been taking classes at Eastern Illinois University to earn my Masters degree in Education. This semester I will be completing my coursework and conducting a study as part of my final project. The study is titled Examination of the Effectiveness of Vocabulary Journals in Science. The students will be given a journal in which they will record assigned words from science class along with the meaning of the word, some synonyms, a sentence using the word, and a picture that shows the meaning. We will work on this for six weeks, and a posttest will be given. From this study I am hoping to see that this is an effective way to help students learn the many vocabulary words they encounter in science class. The results of the study will be shared with Mrs. Meiners and my professor at EIU. Information will be kept confidential since names will not be used when reporting the results. Parents have the option to withdraw their child's data from the study with no penalty to the child. Please feel free to contact me if you have any questions.

Sincerely,

Betsy Collins

Appendix G


Word
Kettle
Meaning
Small depression Formed when chunk of ice left in till melts
Synonyms
Vessel, Hole
Sentence
The elp was a Hidden Kettle where it was walking.
Picture
HeHeH
Kettle Ahhh!
Word
Fossil's
Meaning
Traces of living Formed when things die and are buried by sediment
Synonyms
Trace, Skeleton, Impression
Sentence
I saw a Fossil on the Mesa.
Picture