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Action Research: Using Engaging Vocabulary Instruction in a Science Classroom

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EDHD 4160H

April 13, 2018

Abstract

The focus of this study is to look at vocabulary instruction and how certain techniques affects student learning. This paper evaluates the work that has already been completed within this field of study of vocabulary instruction, focusing on its impact on students and educators. This paper also provides the phases of an action research project focusing on students using interactive activities for implementing vocabulary instruction into a fourth grade math and science classroom. The data collected from this study determined vocabulary instruction improved the students' final test scores at the end of the unit in my classroom.

Keywords: Education, vocabulary, science, action research

Introduction

Integrating interactive vocabulary instruction is critical for the success of students in the classroom. Many teachers know this is important and it is an effective method of teaching, but many do not know how to exactly incorporate it into their classroom. Some may also not know if using multiple techniques in the classroom is more or less effective for their students to learn vocabulary instruction.

Vocabulary instruction in math and science classrooms is typically monotonous and boring. According to Rupley, Logan, and Nichols (1999), "We advocate a balanced approach to teaching vocabulary-at one end of the continuum is writing word definitions and at the other end is learning vocabulary solely through contextual reading and experience. We recommend an eclectic approach in which both direct instruction and wide reading are means for fostering vocabulary development" (p. 336). However, vocabulary instruction in math and science classrooms usually includes the writing of word definitions.

My interest in the topic comes from being a student in EDTL 3010 at the collegiate level. The main purpose of the course was to learn structural analysis and other word recognition strategies as tools for reading fluency, as well as word study and spelling across the curriculum. I remember during my schooling copying definitions from the book into my notebook in order to learn the vocabulary. Then, my teachers would tell us to study these terms and definitions to learn them. After taking this course in college, I now realize this is not an effective method for teaching. I also realize I did not retain a lot of the information from the classes where I copied down definitions. I also vividly remember the classes where we got up and interacted with one another, rather than the classes where we completed bookwork on our own.

I am also interested in this topic because I want to make my classroom environment as interactive as possible while still having my students learn. Most students want to be engaged in an activity, rather than copying down definitions. While this study focuses solely on integrating vocabulary instruction in a science classroom, I hope to include it in my future math classroom. These methods should be used in both classrooms because students still learn better when the activity is engaging and memorable.

Literature Review

One of the methods of instruction I will be using is the concept of definition chart. According to Rupley, Logan, and Nichols (1999),

> "Concept of definition instruction enables students to clarify the meaning of unknown terms by using a hierarchical structure to conceptualize the definition of the new term. Concept of definition makes use of categories, properties, illustrations, and comparisons in order to provide students with a clear understanding of the new term" (p. 343).

This is similar to a concept map, and will be referred in the methodology section as such. Concept maps include the same components, explaining what it is, comparisons, and an illustration.

There is also extensive research on how children learn best. While in the past many teachers have had their students' copy down definitions, this has been found to not be the most effective method.

According to Templeton (2015),

> "Children's minds do not learn words, or about words, by taking mental "photos." They do not learn a printed word by 'staring" at it until its image is imprinted on their brains,

> or by writing it ten times. Rather, mental images are constructed over time and they reflect children's understanding of "the structure of words in general – letters, sounds, spelling and meaning patterns… and specific words that [they] may know' (Templeton & Gehsmann, 2004, p. 40). This is why there is an emphasis on how your students spell words - you'll be able to determine the information they use not only to write words but also to identify words when they read. This is because reading words and spelling words are not separate processes – they rely on the same underlying knowledge of word structure" (p. 11).

In other words, students need to be able to interact with the words in order to learn them. They are not able to look at them and suddenly understand them. According to Stahl (2005), "Vocabulary knowledge is knowledge; the knowledge of a word not only implies a definition, but also implies how that word fits into the world" (p. 2). Giving the students the opportunity to relate the term to their life and their experiences will give students the chance to learn the world effectively.

There is extensive research for vocabulary development in science classrooms. According to Overturf, Montgomery, and Smith (2015), "Vocabulary comprehension is crucial for students to be able to engage in discussions and science activities. When students engage in hands-on science and authentic discussion, they can often relate their own experience to be able to learn science concepts at a deeper level" (p. 24).

This is exactly what concept mapping allows for students to do. In science classrooms, students need to be able to relate to their own experience in order to be successful. Each student has their own background knowledge and experiences to relate the different science topics to. If

students were to do another activity where they were not asked to relate their own experiences and knowledge to the vocabulary term, there would be less retention of the knowledge.

Using a T-chart will also be helpful according to this research. A T-chart is a chart that contrasts two different terms. This method can be used so students can think critically about the differences between certain terms. These charts also give teachers a basis on what the students know and what they don't know. According to Thier (2010), "Your primary task as a science educator is to help students master science concepts and processes. Your role is to be a guide, to trust in your students' intellect, and to continually push them to become more reflective about their learning" (33). Using a T-chart gives students the opportunity to reflect and apply the knowledge they already know to the terms they are given for the T-chart.

There is also extensive research for math vocabulary instruction and what the best approach is. According to Barton, Heidma, and Jordan (2002), "Students need to construct meaning-to grapple with how a concept such as prime numbers is similar to and yet different from other classifications of numbers that they have learned" (p. 26). In other words, students should not just be told what the similarities and the differences between certain words are. They need to figure this out on their own in order for it to be meaningful leaning to the student.

According to Overturf, Montgomery, and Smith (2015), "When students understand the meanings of math terms and phrases and nuances of function words, they better understand mathematics" (p. 23). The T-chart is a good method for teaching for this reason. It gives students the opportunity to understand the math and science terms so they can better understand the concepts.

If I were to extend this research project, I would also include math instruction to see if I were to get the same results as I would with science instruction.

Methodology

The data collected for this action research project was quantitative. The research was collected two fourth grade science classrooms in an Ohio school district. The lessons for science were focused on slow changes of the Earth, including erosion, deposition, and how landforms are formed through these processes. The Ohio Standard that covers these topics is 4.ESS, which states, "Earth's surface has specific characteristics and landforms that can be identified. About 70 percent of the Earth's surface is covered with water and most of that is the ocean. Only a small portion of the Earth's water is freshwater, which is found in rivers, lakes, and groundwater. Earth's surface can change due to erosion and deposition of soil, rock, or sediment. Catastrophic events such as flooding, volcanoes, and earthquakes can create landforms" (Ohio's New Learning Standards: Science Standards, 2011, p. 107). The other content statement covered during this two week period states, "The surface of Earth changes due to weathering. Rocks change shape, size and/or form due to water or ice movement, freeze and thaw, wind, plant growth, gases in the air, pollution and catastrophic events such as earthquakes, mass wasting, flooding and volcanic activity" (Ohio's new Learning Standards: Science Standards, 2011, p. 111). The study took place over a two week period. Students started by taking a pre-assessment over the information they would be learning over slow changes of the Earth.

The first week of lessons consisted of presentations using the website NearPod. This website is similar to PowerPoint, and allowed me to display the information on the slides on their iPads. Each student has an iPad they use every day, so I took advantage of the technology available and made the first lessons on weathering using NearPod. NearPod allowed me to include a quiz at the end of the presentation, which I used as the pre-assessment. This quiz included 4 out of the 9 questions the students would see on the final assessment. The other 5

questions were similar to what the students would see on the final assessment, but not the exact questions.

During the second week of instruction, my Cooperating Mentor Teacher and I used Station Activities to allow the students to have a choice in what activities they did during class time. These stations included Mystery Science activities, Bill Nye videos, song related to the content, and a Quizizz review game. My Cooperating Mentor Teacher and myself coordinated two separate Mystery Science activities at the front and back table, while the other students completed the other activities available to them independently. Students were required to complete all of the activities, and received a Class Dojo point for each activity they completed. Class Dojo is the free management system the school I am teaching at uses, and keeps track of the students' completed work. In the school district I teach in, the students are not graded on a percentage scale. However, for the purposes of this research paper, I will list the results as a percentage as well as a standard score that my school would list it as.

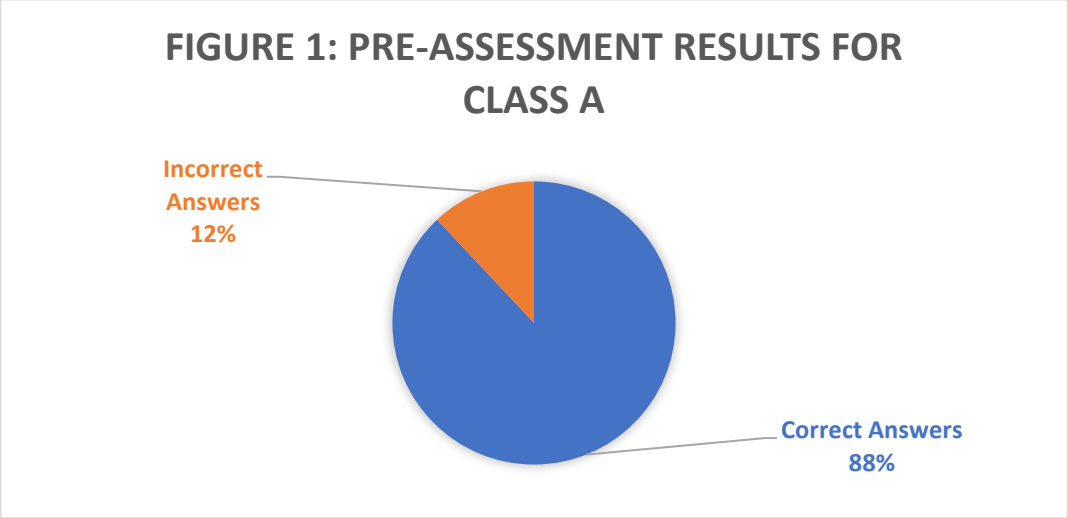
In addition to these lessons described above, I included the engaging vocabulary instruction at the end of the unit a few days before the assessment for my homeroom class. I gave a handout to my class with a T-chart on both the front and back side. One side was labeled Erosion vs. Weathering, and the back side was labeled Erosion vs. Deposition. At this point in the unit, the students have already been exposed to all of the vocabulary for Slow Changes of the Earth. The purpose of this activity was to have a student-led discussion where they students came up with the definition for erosion, then gave some real word examples of where erosion can be seen. The students gave me an example of rocks moving down the local river 5 minutes away from the school. Another example given by the students was glaciers. A similar discussion took

place for contrasting what Weathering is. A student sample of the written work from this activity is included in Appendix A and Appendix B.

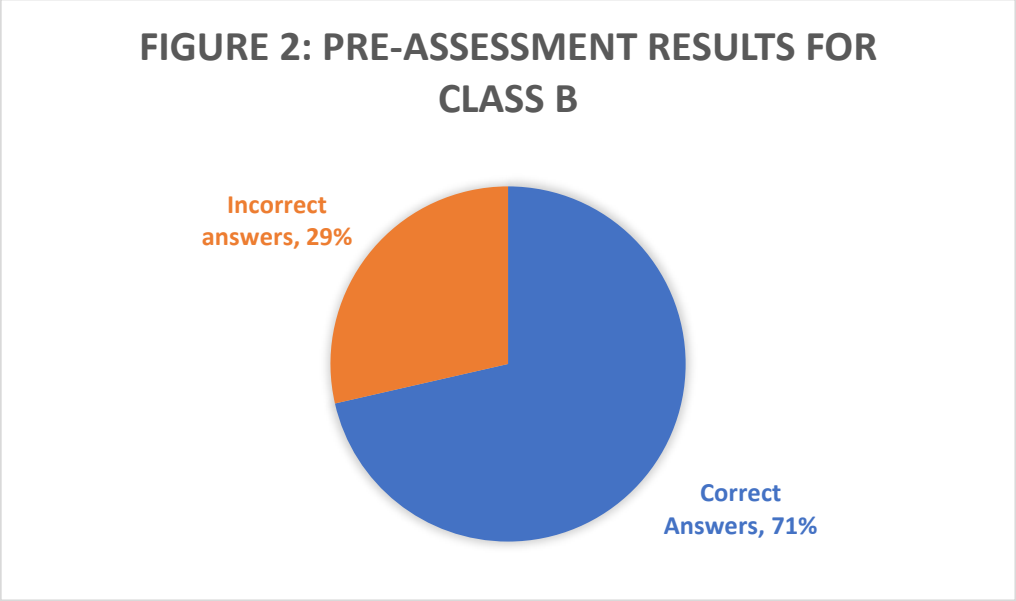
After I have taught the unit using these techniques for my classes, all of the students will fill out a post-test with the same questions on the pre-test. After all of this information is collected, it will then be used to analyze the impact of using one interactive technique in the classroom versus using two interactive techniques in the classroom. By including the information from before the lesson was taught, as well as the information from after the lesson was taught, there will be enough information to draw a conclusion about the effectiveness of using either one or both techniques for teaching vocabulary instruction.

Data and Analysis

The pre-assessment consisted of 9 multiple choice questions. These questions related to erosion, weathering, deposition, and specifically how water affects all three of these slow changes. For Class A, all 27 of my 27 students participated in this pre-assessment. The data for this pre-assessment is represented below in Figure 1. The class scored 88% of the questions correctly and 12% incorrectly.



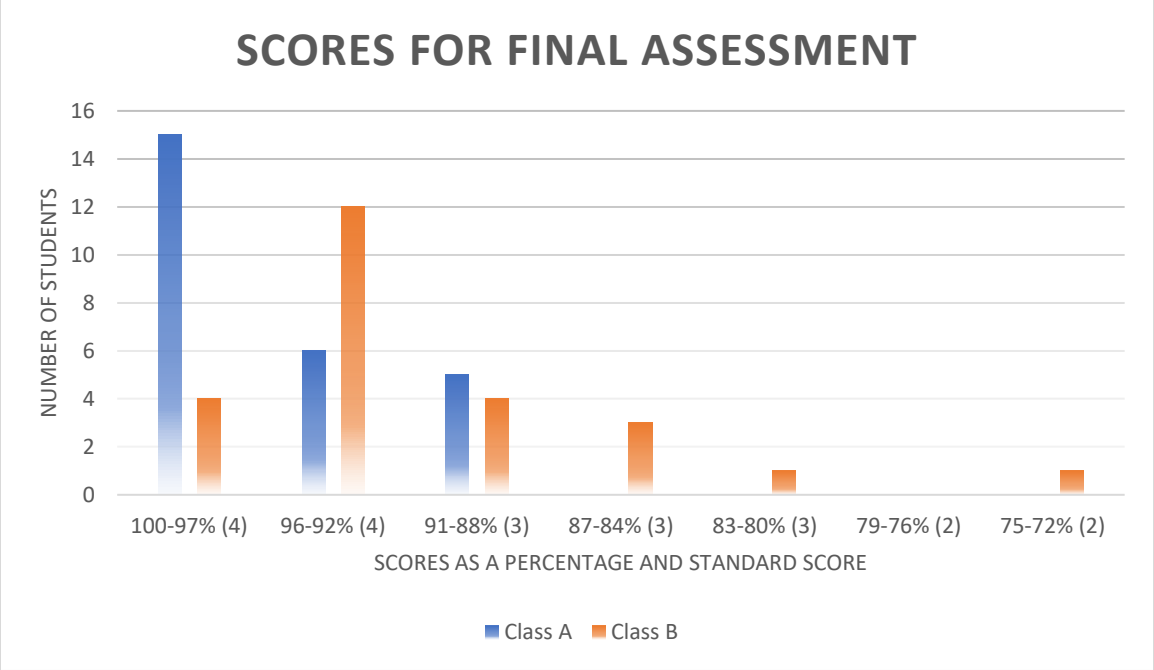
For Class B, 24 of my 26 students participated in this pre-assessment. There were several students absent the day we took this assessment. The data for this pre-assessment is represented below in Figure 2. The class scored 71% of the questions correctly, and 29% of the questions incorrectly.



The final assessment consisted of 32 questions, with 30 multiple choice questions and 2 open response questions. Each multiple choice question was worth 1 point, and both of the extended response questions were worth 4 points and graded based on a rubric made before the assessment was given to the students.

The school uses a standards-based grading grade card to show how well the students are doing with each standard. A 4 means a student is consistently demonstrating mastery of the standards. A 3 means the student is approaching mastery of a standard. A 2 means the student has partial achievement of a standard. And finally, a 1 means the student is not meeting the standard. The goal of this grading philosophy is the have each student have mastery of each standard. All of the teachers in the district challenge each student to reach these high expectations of a 4. Most students will be approaching mastery of a standard, but to show

repeated understanding of a standard is the purpose of this system. The students are then able to be re-evaluated to see if they have retained the information for long-term memory. For the purposes of this research project, I have included both the percentage of questions they answered correctly as well as the standard score a student received based on their final assessment results. Both numbers represent the same final score.



All 27 of my students took the final assessment in Class A. The average grade for first attempts was a 96% for Class A. However, The average of the highest graded attempts was 97% for Class A, which is the class that received the vocabulary instruction at the end of the unit. 21 of 26 students received a standard grade of 4 on the first attempt and 5 students received a standard grade of 3 for this assessment of Slow Changes of the Earth.

All 26 of my students took the final assessment in Class B. The average grade for first attempts was a 92% for Class B. The average of the highest graded attempts was 92% for Class B, which is the class that did not receive the vocabulary instruction at the end of the unit. 16 of 26 students received a standard score of 4 on the first attempt, 8 received a standard score of 3,

and one student received a standard score of 2. A 92% is still considered a "4" as a standard grade. However, the total number of students who received a "4" was lower than Class A.

Conclusion/Implications

The results of my research have encouraged me to continue to use engaging vocabulary instruction in my future classroom. While the majority of my students received a standard score of 4 in both classes, Class A which received the engaging vocabulary instruction scored more 4's than Class B. They also had a high average score on the final assessment than Class B. However, I want to teach it to both of my classes in the future so all of the students reap the benefits of receiving engaging vocabulary instruction. I was not surprised by any of the results of my data collection, as most of my findings were fairly consistent with past research that was described in my Literature Review. I also used vocabulary instruction with the higher level class rather than the lower level class.

There were several limitations of my study. One of the limitations I faced was only being able to complete my research with my science lessons, instead of both math and science. Another limitation I faced was student absences. I had several students in Class A who needed the vocabulary instruction absent the day I taught the lesson. I then had to imitate what I did with the whole class with these students who missed. This could have effected their final test results since they missed a day of instruction. There were also several students who missed the pre-assessment I gave during the first day of instruction. And finally, several students left early for spring break the day of the final assessment, so they had to take it once they came back after a week-long break. This could have impacted their performance on the final assessment.

Another limitation I faced was the school district I teach allows for re-assessment of anything that will go on the final grade card. This means the students are allowed to have as many attempts as they want on the final assessment I gave them. Even though I took the first score the students received for the final assessment into consideration for this research paper, this may have affected their mentality going into the final assessment. A student may not have tried their hardest the first time, knowing they can take the final assessment as many times as they want. I tried to encourage them to give the test their best effort the first try, but there is no way to know what every student is thinking. This mentality could have affected the pre-assessment as well. The students knew in advance the pre-assessment would not count as a standard grade for their report card, so some students may not have tried their hardest and answer to the best of their ability.

A final limitation I faced was my students took a practice test for homework the night before the test. This practice test included some of the same questions that were on the final test. This was a homework assignment I had to include in my instruction to meet the expectations of my Cooperating Mentor Teacher and the school district I was student teaching in. However, this may have skewed the final results because the students had already seen some of the test questions the night before.

Some possible sources of error could include the fact I had to teach my science vocabulary instruction twice. I did my best to cover the same material I did with the entire class with the students who missed. However, with human error there was no way to duplicate my lesson exactly like I did with the rest of my class. There were also some students absent the day of the pre-assessment, as well as the final assessment.

In hindsight, there are several things I could have done differently in order to make my results stronger. For example, I could have used the same pre-assessment and post-assessment. If I had the chance to do another version of this action research project, I would do an engaging vocabulary activity with my lower level students. My two classes are ability grouped based on their knowledge in mathematics, reading, and overall ability to learn. Since I taught my vocabulary activity to Class A with the higher ability, this makes it difficult to see if the vocabulary instruction was the sole factor in Class A's success on the final Unit Assessment.

If I could continue this study with other students in another classroom, I would try using a different method of vocabulary instruction to see if I would get similar results. For example, I would try to use the Frayer Model instead of a T-chart for my next unit, and see if I get similar results to this research. I would also attempt to do a similar research project for math instruction instead of science instruction. I would also attempt to use vocabulary instruction in a classroom that is considered lowered ability to see if this type of instruction improves their overall learning. Finally, I would not allow my students to take a practice test the night before which included some of the exact questions from the final assessment for the purposes of a research project. Finally, I would include a survey piece to my research to and ask students questions like, "How did you prepare for the final assessment?", "Rate how prepared you feel based on the instruction you received on a scale of 1-10.", and "How effective do you feel the instruction was, and what would you want to do differently, if anything, in future instruction?" This would have allowed me to gain insight into what the students' thoughts were before and after the pre and final assessment. I would use this method in future research in conjunction with using a pre and post assessment over a unit.

The main message that emerged from my research was engaging vocabulary instruction that links to their previous experience is effective for student learning. This is shown in the final test results from the Slow Changes of the Earth unit test. However, this may not be the case with every class and every student. I learned a lot about my students and myself through this study. I learned there is no one right way to teach and no one right tool to use. While the T-chart method of vocabulary instruction worked for this class, a different method may be more effective for a different class with a different set of students. Each student has different skills, background experiences, and strengths and weaknesses. As a teacher, it is important to understand what activities allow students to use their strengths to learn, and which activities stretches their abilities to make their weaknesses into strengths. As an educator, I plan to use the information I gained from this research in my future classroom and will continue to evaluate effective vocabulary instruction strategies, including the one used in this project.

References

Barton, M. L., Heidema, C., & Jordan, D. (2002). Teaching reading in mathematics and science. *Educational Leadership, 60*(3), 24-28.

Ohio Department of Education. (2011). *Ohio's new learning standards: Science standards*. Retrieved from http://education.ohio.gov/getattachment/Topics/Learning-in-Ohio/Science/ScienceStandards.pdf.aspx?lang=en-US

Overturf, B. J., Montgomery, L. H., & Smith, M. H. (2015). *Vocabularians: Integraded word study in the middle grades* (pp. 20-24). N.p.: Stenhouse Publishers.

Rupley, W. H., Logan, J. W., & Nichols, W. D. (1998). Vocabulary instruction in a balanced reading program. *Reading Teacher, 52*(4), 336-346.

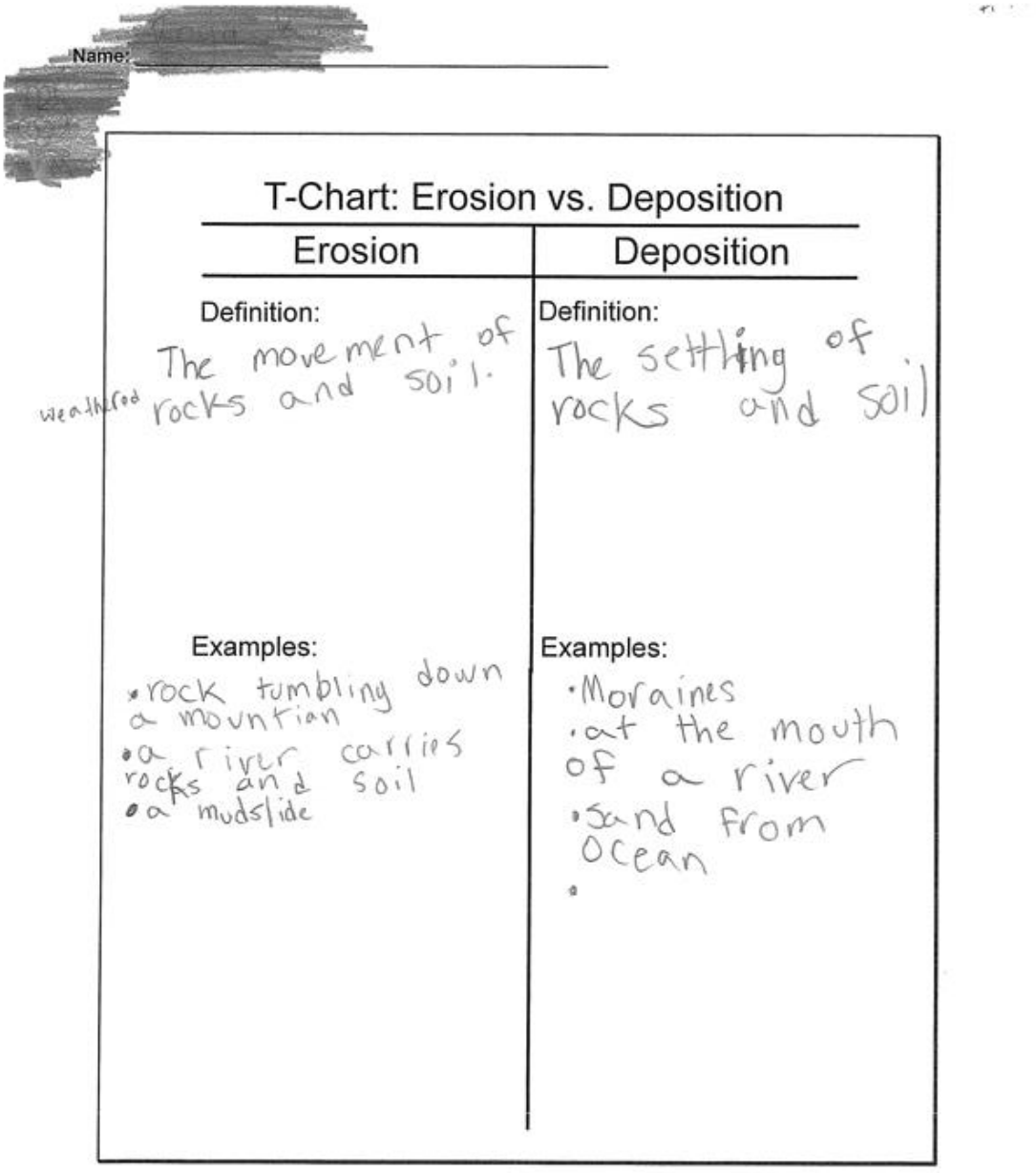
Stahl, S. (2005). Four problems with teaching word meanings (and what to do to make vocabulary an integral part of instruction). In E. H. Hiebert and M. L. Kamil (Eds.), *Teaching and learning vocabulary: Bringing research to practice* (pp. 95–114). Mahwah, NJ: Lawrence Erlbaum.

Templeton, S. (2015). Building foundational and vocabulary knowledge in the common core, K-8: Developmentally-grounded instruction about words. *Language and Literacy Spectrum, 25*7-17.

Thier, M. 2010. Science and literacy: Tools for life. *Science Scope* 33(6), 32–35.

Appendix A

Student Sample of the Vocabulary Instruction: Erosion vs. Deposition



Name: [redacted]

T-Chart: Erosion vs. Deposition

Erosion	Deposition
Definition: The movement of weathered rocks and soil.	Definition: The settling of rocks and soil
Examples: • rock tumbling down a mountian • a river carries rocks and soil • a mudslide	Examples: • Moraines • at the mouth of a river • sand from ocean •

Appendix B

Student Sample of Vocabulary Instruction: Erosion vs. Weathering

Name: [redacted]

[redacted]

T-Chart: Erosion vs. Weathering

Erosion	Weathering
Definition: The movement of weathered rocks and soil.	Definition: The breaking down of rocks and soil
Examples: • a rock tumbling down a mountian • a river carries rocks and soil • a mudslide	Examples: • root wedging • ice wedging • rain can dissolve minerals