



Fun with words in math: A SIOP mathematical unit that involves writing in math.

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This curriculum unit is recommended for: Fourth Grade Math

Keywords: SIOP, English Language Learners (ELL), English as a Second Language (ESL)

Teaching Standards: See [Appendix 1](#) for teaching standards addressed in this unit. (Insert a hyperlink to Appendix 1 where you've stated your unit's main standards. For directions on how to insert a hyperlink, see Fellows Handbook, p. 29.)

Synopsis: With this unit I hope to provide students the ability to see real world examples of math that they are learning now and can later apply to everyday life. With many students coming from different parts of the globe, speaking many different languages, it is hard for them to not only learn what their peers are learning, but also learn a foreign language. There are many stresses that go into learning a new language, such as not being confident enough to ask questions, talking to peers, or becoming introverted. In this unit, using the SIOP model of teaching, sheltered instruction observational protocol, students will create a dictionary to help students have a reference on math vocabulary that we have used and practiced since their kindergarten year. They will research a specific word and become an expert on that word, where they will then share what they have learned in front of the class.

I plan to teach this unit during the coming year in to 23 students in math to fourth graders.

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Stephen Salisbury

Introduction:

With this unit I plan to expose students to common mathematical vocabulary. We have all been there, sitting in class and have been completely lost and have no idea what the teacher or professor is talking about. Sum, decimal, dividend, divisor, product, and array, these are just a few vocabulary terms that fourth graders are exposed to everyday. Now these don't sound too difficult to express or define too many people, however imagine trying to learn the vocabulary words that your peers are learning on top of learning a brand new language or coming from another country. Not only are students today learning a new language, but they are now being taught the academic language that every student must learn.

This unit will help students who come from different backgrounds and languages to become familiar with everyday math words. They will develop a true understanding of the concepts by creating a student friendly dictionary, which will provide their peers the ability to look up a term or equation and have a basic explanation of what they need to know.

Students will develop this dictionary by providing a grade appropriate definition to fit the word, a picture or diagram to express the definition, and finally provide a real world example of the term. By providing a real world example, students will now have an answer to the ever popular question: "When will I need this in life?" Students will see first-hand why and how they use the terms and concepts that they are being taught.

Background:

I am currently employed as a fourth grade teacher at Crown Point Elementary School in Matthews, NC. Matthews is a suburb of Charlotte, lying just off Independence Boulevard. The housing in the Crown Point area is primarily made up of many apartment complexes and housing developments. Due to this, the student population tends to be transient. Over my four years at Crown Point, I have seen many of my students transfer out or move away from the area.

Crown Point is a very diverse school with students coming from over 60 different countries and cultures. After English, the second most spoken language at school is Spanish. Many of the student's hail from Central America, Africa, and Eastern Europe. While this provides a diverse environment for students to learn about other cultures and backgrounds, it makes it create a challenge when teaching ESL students. Visual teaching is must when teaching students with such a diverse background as it found at Crown Point.

My grade level, made up of five teachers of five classrooms, is clustered into academic groups based on student aptitude levels. The grade is broken up into three additional groups: Two classes are designated for Exceptional Children (EC), two classrooms for the English Language Learners (ELL), and the last contain the Talent Development (TD) students.

I currently teach one of the ELL classes. My class contains 12 students who have qualified for the ELL program and two to three other students who are considered on the fringe of qualifying. The remaining 11 students range from above grade level to performing below grade level. In addition, I have one student who is also qualified for the EC program, and, at one point had qualified for the ELL program but has since tested out. Within my ELL group I have students who can speak only Spanish and have limited to no comprehension of English. Others can speak and read English, but their comprehension is at a grade to two grades below where they should be. The other eleven students have a large range of comprehension with some performing above grade level and others performing at or below grade level.

Due to the high number of ELL students in my class, I must tier lessons to include more visuals, the acting out of ideas and thoughts, as well as more interactive hands on learning through activities such as games and experiments. This presents many challenges when teaching to a group of students who are learning a new language. Students struggle to learn what their peers are learning while acquiring a new vocabulary. English speaking students may already find the new concepts difficult to grasp, which brings to light how much more of a challenge learning is for ELL learners.

In this unit I plan to have students create a dictionary of vocabulary words with pictures, examples, and explanations that they have generated. The belief is that if students are provided with a more hands on approach they will have a more thorough understanding of the concepts that they are being taught.

Students are exposed to new language and vocabulary every day. By creating a poster about the lessons and vocabulary they have learned the visual representation will allow them to gain a deeper understanding of the terms. They must provide a student friendly definition, explaining exactly what the word means. By creating this type of definition, it allows them to see any common misconceptions that other students may find and allows them to self-correct their mistakes or errors. Students will then provide a picture or a visual description of the word. Visuals are key to a person learning a new language. If they cannot read the definition, the picture or graph will allow them to still comprehend the term or concept. Finally, students will have to present a real world example of the vocabulary word to cement their understanding. The real world description will include area, multiples, factors, or fractions for example. The students will be provided a rubric based on the following:

- The definition of the word

- A picture example of the word
- Real world example to the word
- Creativity
- Overall neatness of poster

Once all student's posters are complete we will create a student math vocabulary dictionary. This dictionary can then be given to the ELL department for future students to have and learn from.

Content Objectives:

This will be an interdisciplinary themed unit. The creation of the poster and dictionary will take approximately two weeks to complete. Students will be given time in class to work on their posters and will be assigned time during their homework to complete. Collaborative writing will be integral in this unit. Studies show that writing during math and literacy lessons improves reading comprehension, and performance in science and social studies. According to David Pugalee:

“Writing supports mathematical reasoning and problem solving and helps students internalize the characteristics of effective communication.”

With the Common Core state standards, education is being centered on student driven, inquiry based learning. A curriculum mandate at Crown Point requires the incorporation of writing into every subject. The inclusion of writing in each subject strengthens students writing skills and reinforces the topic they are learning. This requirement also provides ELL students with another means of communication with their peers. By having the students create their own dictionary, they know that they will be creating a tool that other students will be learning from throughout the year. This creates a sense of responsibility and ownership, knowing that others will have their work to study and learn from.

During the creation of the dictionary the students construct their own definitions in terms that are grade appropriate. It is expected that the definitions will be easily understood by the student's peers. Peer to peer teaching requires students to first understand the concept being taught. If they understand it, then they will be able to teach it. With having many students who speak other languages, this will allow them to understand math both as a language itself, and also by learning the language taught in class. The project will benefit non English speaking students on two fronts – by teaching them that math is a language in itself and reinforcing their understanding of the English language.

Cooperation and synergy are additional themes in this unit. These two ideals are an integral part of the new curriculum that Crown Point has implemented this year. Students will be placed into heterogeneous partnerships with one another. These partnerships will generate conversations between both peers to help each other understand what is being taught. An example of this is the pairing of two Spanish speaking students with stronger English comprehension with two other Spanish speaking students who need more help. The idea is that the students with the stronger English language skills will be able to help convey the concepts on the lesson in an easier way for their partners.

This year our school has adopted the program called *The Seven Habits of a Happy Kid*. The seven habits that our students will follow are:

- Being proactive
- Begin with the end in mind
- Put first things first
- Think win-win
- Seek first to understand, then to be understood
- Synergize
- Sharpen the saw

The students are exposed to these habits on a daily basis throughout the school. They hear and see these terms and must practice the habits everyday. With this unit, students can incorporate some of these habits into their daily routine. Providing the rubric to students beforehand allows them to understand what is expected and can begin with the end in mind plan their days with the habits in mind. It is key that students develop skill of prioritization in this grade. Many students participate in afterschool activities and they will need to use their learned skills to complete their homework and the assigned take home activities for this project. Without prioritizing time, ~~they~~ students will affect the progress of the project and will cause both themselves and their paired partner to fall behind. Working together, students must ensure that they understand the topic. The hope is that the more advanced learners will first understand and then help their partners to with the parts they are struggling with. After this the pairs will work together to creating their poster for the class dictionary.

Many students constantly ask me, “When will I ever use this in my life?” By creating a real world example of how and when they will use ~~this~~ the concepts, it students an understanding of instances where math skills are being used without truly realizing it.

Teaching Strategies:

The unit will encompass the different learning styles held by most students. There are many different learning styles that this unit hopes to hit as many as it can. Those

styles are visual, auditory, kinesthetic, social, solitary, and logical. By having each style expressed allows all learners to benefit and grow with the project. From prior experience, I have seen the benefits of reaching across all learning styles and providing students the ability to show their learning. Not only do they become more engaged with what they are doing, but everyone gets involved.

To start this project we will review the concept of a dictionary, including an example of how it is used for and real world examples and then using the website <http://www.amathsdictionaryforkids.com>. This will show how pictures can be used to show definitions of words. This website will provide examples of how pictures can be used to show definitions. Additionally, the website has an interactive section that will be used for inquiry-based learning. Classroom Smart Boards will be used to access the websites so student will be exposed to a kinesthetic style of learning.

As mentioned earlier, students will be working in heterogeneous groups will allows students to engage in peer-to-peer learning. This will provide opportunities for the pairs to work through misconceptions that they may have. They can work jointly through any difficulties that may present themselves. These conversations between the pairs will benefit those who learn best through discussion and auditory learning.

Using the poster as a creative medium allows students who learn through creative action and visual cues to further grasp complex lessons. The poster will allow the students to put their mastery of their assigned concepts on display and in turn helps their peers to learn. With ELL heavy classrooms, the visual aspects of the project are the key to its success. The project provides students with the opportunity to learn new vocabulary and bridge the gaps between their native language and English.

Math Activities:

Introduction to Dictionary:

To introduce the importance of vocabulary in math, students will be provided a problem in a different base instead of base ten, ex. $3 + 3 = 10$ is the base of 6. Called Martian math because it is assumed Martians only have six digits on their hands, unlike Earthlings that have ten digits on their hands. This will confuse the students and allow them to ask questions on how this problem exists. Once the teacher informs them that this problem is in the base of 6 instead of base 10, which they are accustomed to using, and teach them how $3 + 3 = 10$, they will then see the importance of knowing what the term base means and place value. As a class, we will generate terms that are used in everyday math lessons. What do you think is important and why is it needed? Other academic terms that are used on tests in word problems will be added to show and define them for students to use.

Graphic organizers:

A key concept to the SIOP model is to provide graphic organizers for ESL students. This will allow the project to be broken up into pieces and chunks and not overwhelm students. Graphic organizers provide complex ideas and concepts to be broken down. They can keep up with native speakers and not feel embarrassed on being slower to write. They can focus more on the listening of the lesson and not be bogged down on trying to write and listen at the same time.

Small Group Instruction:

Students will be working in small groups which will be supervised by the teacher to ensure correct definitions and examples are being used. Working in small groups provides students a direct access to the teacher to ask questions and quicker feedback. Small groups also will alleviate some stress of talking in front of a large group of people in the beginning. With students who are new to the language, it will allow them to be more relaxed and takes away many of the stresses of them talking in front of peers and saying mistakes.

KWL Chart

Students will create a KWL chart to begin the topic. A KWL chart is a chart that is divided into thirds. Students activate prior knowledge in the K or know part of the chart, then ask questions on the topic in the W section, what they want to learn. Finally, after the lesson has been taught, they write down what they have learned in the L section. What do they know when about the word? What do they want to learn? Finally, what they did learn will be shared with the whole class when presented on. This activity will get the student to start thinking about math in everyday life. It will create a more authentic approach to learning a new term if they can see why they are learning something and will use it every day, as they get older.

SIOP Model for teaching:

SIOP, sheltered instruction observational protocol, is a method of teaching ELL students. It is comprised of four areas:

- Reading
- Writing
- Listening
- Speaking

Since having many ELL students, my school and administrators have shared this model for me to use in class. I find that it helps with ELL's because it provides visuals for students to look at and not just read or listen. It provides time and activities for students to talk and discuss with their peers and other native speakers about what they are learning. Native speaking students can be role models and provide the ELL students an example of how to properly use the language, as well as slang and idiom phrases that people use everyday.

One of the goals of this curriculum unit is to hit all four of these areas of the SIOP model of teaching.

Reading:

Students will be given a list of mathematical terms that we have used and are going to use throughout the year. They will choose which one they want to become an expert of and teach that term to the class. To build confidence, students will each choose a different word, there will be no overlap among students and terms. This is so that students who are learning the language are students who are less likely to speak in front of class, are given the authority to research and share their word without anybody else in class saying that they are wrong.

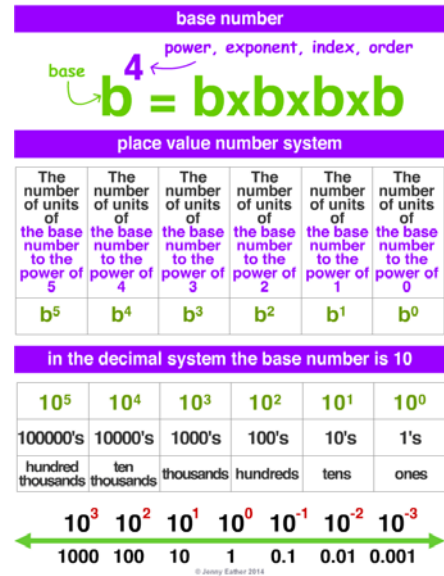
Researching the word will be done in small groups in the classroom, being supervised by the teacher to ensure correct use of term. Computer lab time to research, with provided websites, and additional time during the end of the day with iPads and Chrome books. For students who leave for ELL class, ELL teacher will be provided lesson plans to help students participate and not fall behind on their research. Having the collaboration with the ELL teacher also provides feedback on where else I could be servicing the students according to their IEP and other legal documents.

Writing:

After completing research of their term, students will then have to come up with a sentence or two that describes the meaning and use of the term. The definition should be students friendly, meaning, every student in class should be familiar with all the words in the definition and can use them correctly when asked. Terms that only half the class has been exposed to will not help every student in class.

Listening:

Students will listen to each of their peer’s presentation of their term. They are encouraged to answer questions that they may have and add anything that they may want to know. By listening to peer’s talk and present it allows ELL’s to listen to native speakers of the language they are learning. What do they sound like, what do they say? They will hopefully try and mimic and learn the language faster with practice and application.



Speaking:

Students will present what they have learned and teach it to the class. They will become teachers of their word. Through teaching the term, students will learn more and have a better understanding of the material. When dealing with ELL’s, it helps them practice the language and allows them to practice speaking in front of others. Since they are the only ones teaching the class about their term, they have the confidence to present the class without anyone else second guessing their presentation or definition.

Terms:

Terms for the dictionary will be student generated. What do you think you need to know in terms of vocabulary will you need to solve this problems? How would you explain this problem to a person who has never heard of this before? It allows students to think of ways to create synonyms, antonyms, and explain why they are doing what they are doing. It provided evidence on how and why we are doing operations operations a certain way, why they work.

Complete Dictionary:

Finally, the culminating activity will be to put the dictionary together. Students will work on alphabetizing the words and set it up as a dictionary is set up. Each paper will be uniformed on regular 8 1/2 by 11 construction paper. Each letter will be color coordinated to help find a certain letter easier.

The dictionary will be placed in the classroom for student’s wo utilize it when needed. Instead of asking what the term means, they can now go up and look it up for themselves, a skill that they can now use for the rest of their lives. The dictionary will also be used as a working document, and constantly added to. As a class, students can add terms they feel that the dictionary could have and put in the proper place.

Assessment:

For teachers who like to have final assessments on presentations or listening, they can simply take all of the words provided and use as a final assessment on vocabulary.

The assessment could provide a sense on what terms students struggled to most with, which the teacher can use to teach that student more about the term. It will also provide the students the information on what they didn't quite understand and have the person who completed and researched that term to help explain and clarify.

A final culminating problem for the students to do will be to put that problem of $3 + 3 = 10$ on the board once again. They will be able to explain the problem using the vocabulary learned during the project and use the correct terms and vocabulary for it. The chart below is something that students can solve and find out what base the number system is in. Using vocabulary learned throughout the project students will be able to use proper terminology and be able to describe what the chart is representing.

Martian numbering:

	1296	216	36	6	1
0					0
1					1
3					3
4					4
5					5
6					10
7					11

Rubric:

This rubric show below provided by Irubrics.com, can be used for teachers to assess each students project and definition. The rubric should be provided to the students prior to them starting the project to give them a guideline on what is expected and where they need to put work into.

	3	2	1
Definition parts	Expert The dictionary has: 1.a definition of the math term 2.a picture to represent the word 3.an example	Practitioner The dictionary is missing one of the three criteria for some definitions.	Novice The dictionary is missing any of the three parts.
Number of terms	Expert The dictionary contains a minimum of 15 terms.	Practitioner The dictionary contains 10 terms.	Novice The dictionary contains less than 10 terms.
Neatness/Aesthetics	Expert The dictionary is neatly done and visually appealing.	Practitioner The dictionary looks somewhat rushed.	Novice The dictionary looks as if little effort was put forth.

Appendix 1: Implementing Teaching Standards

Math:

Number and Operations-Fractions

- **CCSS.4.NF.A.1-** Show what a fraction is by defining each part, ex. Numerator and denominator, halves, quarters, thirds. Provide visuals to express by what a fraction represents.

Operations and Algebraic Thinking

- **CCSS.4.OA.A.1-** Show what each part of a multiplication and division problem are by defining the many different frequent words, ex. Product, factor, divisor, dividend, quotient, and array.

Measurement and Data

- **CCSS.4.MD.A.3-** Show different units of measurement by expressing the size in comparison to other units. Show and differentiate between perimeter and area.

Literacy:

Writing

- **CCSS.W.4.2-** Create and express a topic to show what each vocabulary word represents.
- **CCSS.W.4.4-** Create a student friendly dictionary to help define common math terms used throughout the school year.
- **CCSS.W.4.7-** Research and discover what terms represent and how to express them to peers for them to understand.

Speaking and Listening

- **CCSS.SL.4.1-** Students will work cooperatively and discuss the topics being learned.
- **CCSS.SL.4.4-** Report their word to their peers for them to learn what they have created. Students will teach each other on the topic being presented.

Reading: Informational Text

- **CCSS.RI.4.4-** Students will interpret and define academic language to student friendly versions.

Resources and Readings:

The 7 Habits of Happy Kids by Sean Covey and Stacy Curtis- This story introduces and informs students and teachers on habits that successful and happy kids and adults do to become successful.

<http://amathsdictionaryforkids.com/> is a website that provides an online version of terms and examples of ways the students can outline their term. It provides real world examples and interactive use of the term.

School Reform and Standards-Based Education: A Model for English-Language Learners by Jana Echevarria, Deborah Short, and Kristin Powers and *Using the SIOP model for Effective Content Teaching with Second and Foreign Language Learners* by Veronika Karevawas were readings used for teaching the SIOP model. It provides teachers with activities and outlines the benefits on teaching the SIOP model to ESL students and native language speakers.

IRubric: Math Dictionary Rubric was a site that provided the rubric used above.

Writing, Mathematics, and Metacognition: Looking for Connections Through Students' Work in Mathematical Problem Solving by David K. Pugalee, *Using Writing Mathematics to Strengthen Student Learning* by Vicki Urquhart, and *Writing to Learn Mathematics* by Franco Vivaldi were readings used to relate the importance of math and writing to learn math.

<http://math2.uncc.edu/~hbreiter/>. Was the website of our seminar leader and professor Dr. Reiter. It provides explanations used during our seminar and used to explain Martian Math and importance of place value.

www.teacherspayteachers.com a website that was used for getting the KWL chart. On it is a bunch of ideas for teachers to use and post ideas to share.

<http://www.dailyteachingtools.com/free-graphic-organizers-s.html> was a website used to get graphic organizers students can access and change to what I needed to

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