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# Soleado

Promising Practices from the Field

## Math Poets: Mathematical Language Through Artful Expression

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### Snakes, Spiders & Math

There are three things most people are afraid of: snakes, spiders, and math. These fears have long plagued man. One cause of this fear is math anxiety. Research has shown that math anxiety stimulates the same area of the brain that activates when encountering snakes and spiders (Young, Wu & Menon, 2012). Young, Wu, and Menon studied brain scans of children experiencing math anxiety and found that activity is reduced in the information-processing and reasoning areas of their brains. Also, the amygdala, a region of the brain responsible for processing negative emotions, becomes hyperactive at the expense of the dorsolateral prefrontal cortex and posterior parietal

areas of the brain needed for mathematical reasoning (2018). According to their study, these two areas of the brain are connected; math anxiety interferes with a student's ability for mathematical performance and reasoning.

### Second/Foreign Language Anxiety

Understanding the role and the importance of math anxiety in math instruction is important in helping students understand and perform mathematics, however, language acquisition anxiety may

also be present when English learners are being taught to read, communicate, and write in mathematics.

Anxiety associated with learning a second or foreign language is considered a multidimensional phenomenon

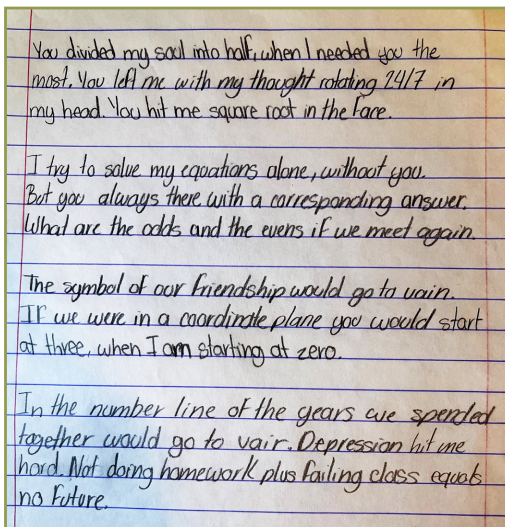
(Hashemi, 2011). It can be defined as “a subjective feeling of tension, apprehension, nervousness, and worry associated with the arousal of the automatic nervous system” (Macintyre & Gardner, 1994). According to Horwitz (1986) feelings of second/foreign language anxiety target the two fundamental requirements of foreign language learning, listening and speaking. Recognizing anxiety is a psychological

construct, likely stemming from the learner's self-perception as an intrinsic motivator (Hashemi, 2011); math and second language anxiety is a compound hurdle for English learners in mathematical instruction and an important factor in developing a learner's mathematical language. Recognizing the role anxiety plays in students' learning led us to consider ways to help our students overcome it.

### The Language of Mathematics

Mathematics is a modern and specialized language with concepts and symbols that

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Students in Dr. Acosta's middle school mathematics class write poetry using math vocabulary.

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must be learned (Esty, 2022). Similarly, even if you can do some math, you may not be able to read math. According to Esty (2022), to be fully proficient in the symbolic language of mathematics you should be able to efficiently read, write, learn, and think mathematical thoughts. Developing the language of mathematics is an essential aspect of teaching mathematics to students and continues throughout an individual's mathematics education (Riccomini, Smith, Hughes & Fries, 2015).

### *The Gateway to Mathematics*

When I first started college, I struggled with understanding math. I had dropped out of high school and had not received the mathematics instruction my classmates had received, so to describe me as lost in math would be considered an understatement. I was a few years younger than my classmates, but I knew the importance of getting a college education. I had to find a way not to fail again. It was during my second attempt at basic college math that I realized I could not interpret what the math professor was saying. I could not connect linear equations, functions, or distributive properties to any prior knowledge I had. One day, I was flipping through the pages of my math books and, in the back of the book, I found a mathematical glossary. It became the cipher I desperately needed for the language of mathematics. I studied the math words intensely. I attached the words to the pictures. I tried to use the words in sentences, speaking them out loud, and finally connecting them to mathematical strategies and properties.

### *The Cipher: Mathematical Vocabulary*

Providing appropriate academic language support is important for all learners, especially in the mathematics classroom, where the ongoing development of explicit mathematical vocabulary is essential (Bay-Williams & Livers, 2009 cited in Riccomini, et al., 2015). There are three main purposes for teaching essential vocabulary in mathematics. According to Riccomini, et al. (2015), the first is to provide initial instruction to promote the understanding and storage of word meanings in long-term memory. Second, and only after students have developed that understanding, the goal becomes to help students become fluent and maintain the words' meaning over time. Third, the result of achieving the first two goals is that students can easily and accurately use the language of mathematics to explain and justify mathematical concepts and relationships. Without the instructor first teaching basic understanding and facilitating fluency with vocabulary words, the purposeful and effective use of the language of

mathematics will not occur (Riccomini et al., 2015).

Vocabulary supports comprehension. However, approximately 70% of students in middle and high school experience difficulties with vocabulary and reading comprehension (Biancarosa & Snow, 2004). All students, including English learners and students with learning disabilities, benefit from explicit vocabulary instruction. A focus on mathematical vocabulary helps students explain, justify, and otherwise communicate mathematically and is important to the overall development of mathematical proficiency.

### *Math Poets*

During an early morning ride to school, my wife, who at the time happened to be an awesome 6th-grade math teacher, discussed with me this trifecta of a problem; the acquisition of the language of mathematics, the fear and anxiety of mathematics, and English learners acquiring a third language: math. I shared with her my story of how I found a cipher to the language of mathematics in the glossary at the back of my college math book. She in turn, shared her experiences acquiring English as a first-generation English learner. During that early morning drive, we developed a creative poetry lesson to help our students develop mathematical vocabulary. This activity promotes the language of mathematics through artful expression and reduces the fear of mathematics.

### *Lesson Preparation*

We began this activity by clearly defining our math objective in which students would be able to connect math terms to the real world. Our language standard indicated students use clear definitions in discussion with others and in their own reasoning. WIDA's English Language Development (ELD) Standard connecting language development and academic content learning was addressed by having all students, including the English learners, communicate information, ideas, and concepts that are necessary for academic success in the content area of mathematics.

### *Materials/Key Vocabulary*

This cross-content activity required the frontloading of key vocabulary terms and the introduction of the *structure* of a poem to help students in this activity. These structures, or elements of poetry, include meter, rhyme, scheme, verse, and stanza, which were important vocabulary terms to introduce. Visual examples and graphic organizers displaying poetry

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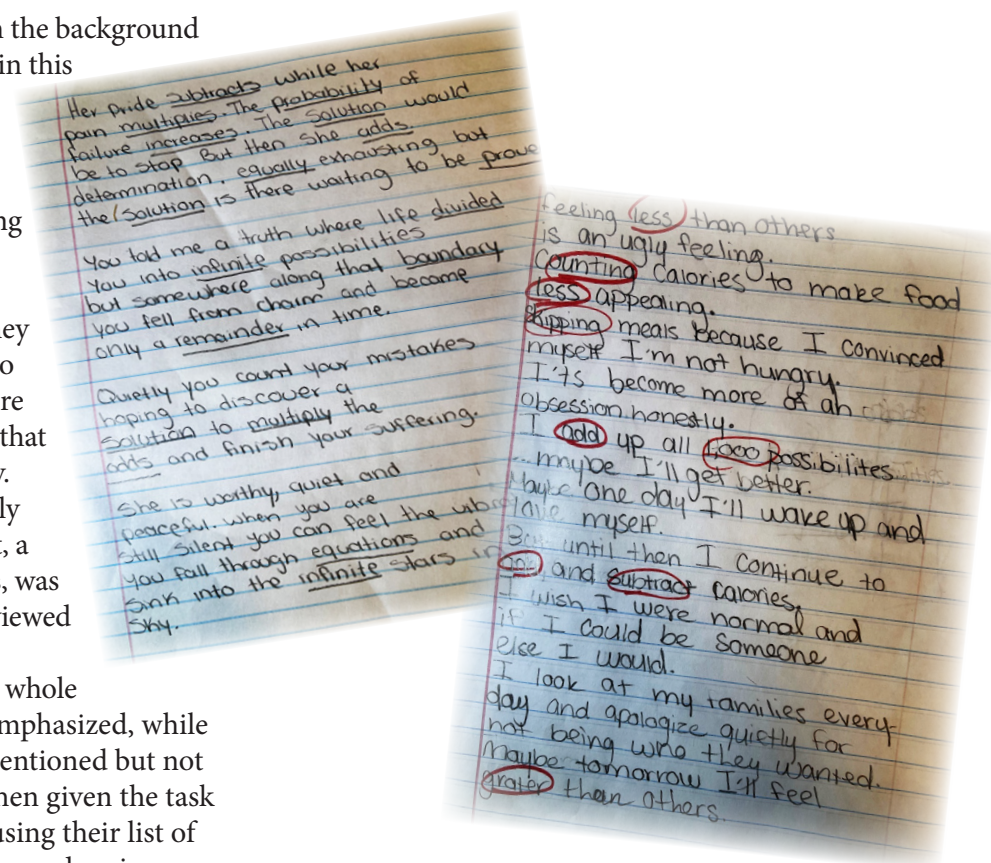
elements supported students with the background knowledge needed to participate in this math activity.

## Motivation

We began the lesson by referencing the math word bank that every student in our school has and asking them to list math words they remembered from kindergarten to their present grade level. They were then asked to cross out any word that they were not able to define orally. Once the students had individually written their math vocabulary list, a math poem, supported by images, was read to them. Vocabulary was reviewed and explained through the visual representation and discussed as a whole group. Stanzas and verses were emphasized, while rhyme, meter, and scheme are mentioned but not highlighted. The students were then given the task to create their own Math Poem using their list of math vocabulary words. Students used various tools to verify the meaning of words.

This activity required students to make numerous edits. They were required to edit grammatically and verify that the math terms were used appropriately. Students read their math poems over and over again and edited accordingly in order to meet their personal standard of excellence. Once all students completed their math poem, a gallery walk provided an opportunity to applaud others' work. Students who wanted to stay anonymous wrote their names on the back of their poems, while others offered an alias to hide their identity.

The importance of vocabulary development in any language is crucial in learning how to write, speak, and understand mathematics as a language. Van der Walt (2009) emphasized that vocabulary within the language of mathematics is an aspect of instruction that requires specific attention. We have discussed the importance of recognizing anxiety prior to instruction and its impact on learning. The activity presented promotes mathematical vocabulary development using a cross-content activity that incorporates instructional best practices and may help engage students in mathematics in contrast to more traditional computational approaches.



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