ACTIVTY ONE: Vocabulary Activity – Everyday Words in Mathematics

(modified from O'Connell & Croskey, 2008)

Directions: Complete each column. These words have meanings in everyday language and in mathematics, sometimes it is the same and sometimes not. A word may have more than one meaning in either column. Many times there is a connection between the two.

FOR THIS SESSION ONLY PICK TWO WORDS TO COMPLETE!

Word	It usually means…	In math it means…	The connection is…
Difference			
Factor			
Power			
Product			
Round			
Similar			

Sample questions to deepen learning from Activity One

1.) How is the word *difference* used in everyday language? Can you give some examples of this?
2.) In mathematics, what do we mean when we use the word *difference*? Can you give some examples of this?
3.) From our discussion, do you think there is a basic similarity between the two usages? If yes, what is it? If not, why do you think the word was chosen by mathematicians?
4.) In mathematics textbooks, many times the word *difference* is used in both ways to explain a concept. Any ideas how you can tell which usage the author intends?

Goal: This activity should make students aware of the variation of meanings that words can have based on the context, everyday language, or mathematics. By you acknowledging the variation in meanings, you can help eliminate student confusion.

ACTIVITY TWO: Find the Vocabulary

Read the paragraph below and circle the words which students would need to understand in order to comprehend the statement. (P PreAlgebra: A Worktext by D. Franklin Wright, 4th ed. This is section 10.1, titled Introduction to Geometry). Underlined words are new vocabulary according to the textbook author.

Every angle has a measure associated with it. If a circle is divided into 360 equal arcs and two rays are drawn from the center of the circle through two successive points of division on the circle, then that angle is said to measure one degree.

Sample questions to deepen learning from Activity Two

1.) Which words did you circle? (Write on the board, the words the students offer.)
2.) What means do you have to find out what these words mean in this paragraph? (You can expect answers like: glossary, reading the textbook, looking in other resources, asking others.)
3.) Let's take the word *angle* – what is a workable definition that is easy to understand that we write down?
4.) Now that we have found workable definitions for the words we wrote on the board, let's rewrite the paragraph so that we can all understand it. (You can ask the students to do this in groups or pairs and to then share. Ask questions about why the students decided what they did.)
5.) Is there a graphic we could include to help clarify this paragraph also?

Goal: This activity should make the students aware that they can rewrite any text in the textbook so it makes sense to them. This extension also gives them some experience doing so.

ACTIVTY THREE: Gesturing Activity (aka Motor Imaging)

(References: Harmon, Wood, & Hedrick, 2006; Manzo & Manzo, 2008; Reiss, 2008; Zwiers, 2008)

For this session, choose 2 words and for each word create a gesture that can represent the mathematical meaning.

Area	Intersection	Reflection	Tangent
Circumference	Matrix	Similar	Union
Continuous	Perimeter	Slope	Vector
Discrete	Reciprocal	Symmetry	Volume

Example for gestures is from Harmon, Wood, & Hedrick, 2006.

Word	Mathematical Meaning	Gesture
Polygon	A polygon is formed by 3 or more coplanar sides. Polygon sides that have common endpoints are noncollinear, and each side intersects exactly 2 other sides, but only at their endpoints.	Elbows out, hands in, middle fingers of hands touching in front of the body.
Convex	A polygon is convex if any line containing a side of the polygon does not contain a point in the interior of the polygon.	Straight hands, middle fingers touching and pointing away from the body like an arrow.

Sample questions to deepen learning from Activity Three

1.) Who created a gesture for *tangent*? Show it to us.
2.) Why did you decide that was a good gesture? How is the gesture related to the mathematical meaning?
3.) Anyone have a different gesture for *tangent*? (You can have a competition and let the students vote on the best gesture OR you can choose the best one based on how well the gesture represents the word's mathematical meaning.)

Goal: This activity offers students a kinetic method to connect vocabulary words with meanings. This can be used for all types of words/concepts in mathematics. This vocabulary strategy is particularly helpful for second language students. Sometimes, abstract words and concepts may present a challenge to find a meaningful gesture!

Example: Word Sort for a Unit Exam Review (Pre-Algebra)

(Barton & Heidema, 2002; O'Connell & Croskey, 2008)

Vocabulary / Concepts		
Additive identity property	Distributive property	Polynomial
Area	Divisor	Positive integers
Associative property of addition	Equation	Power
Associative property of multiplication	Estimate	Product
Average	Evaluate	Quotient
Base	Exponent	Remainder
Change in value	Expression	Round
Coefficient	Factor	Simplify
Commutative property of addition	Integers	Solve
Commutative property of multiplication	Like terms	Sum
Compute	Multiplication identity property	Terms
Constant	Natural numbers	Unlike terms
Difference	Negative integers	Variable
	Order of operations	Whole numbers
	Perimeter	Zero factor law
Categories		
Key Words	Parts of equations/expressions	Properties/Rules
Math Applications	Parts of polynomials	Types of Numbers
Math Instructions		

Unit 1 Review Word Sort Activity – Student Handout (space to write was reduced!)

Types of Numbers	Math Instructions
Properties/Rules	Math Applications
Parts of equations/expressions	Key Words
Parts of polynomials	

Sample follow-up questions for Word Sort Activity to deepen learning:

1.) Did your group find some of the words could be placed in more than one category? If so, which one(s)? Explain why.
2.) Did your group agree with the categories that were given? If not, what would you have chosen?
3.) Did your group see how some words/phrases were related that you weren't aware of before? Which ones?
4.) How did your group approach the word sort? How did your group start?
5.) Did your group use the textbook much to check on some of the words/phrases? Why? How did you use the textbook?
6.) Did your group notice some overlap between Chapter1 and Chapter 2, meaning that a word/phrase occurred more than once? Can you give an example?
7.) Which words or phrases did your group find the most difficult to place into a category? How did you finally decide which category to leave it in?
8.) In the Math Applications category, could your group provide an example of each type of application?
9.) In the Math Instructions category, you have placed "simplify". If that word is in the directions would you expect to be working with expressions or equations? Why?
10.) In the Math Instructions category, you have placed "solve". If that word is in the directions would you expect to be working with expressions ore equations? Why?
11.) In the Types of Numbers category, you placed "natural numbers". How do they differ from "whole numbers"?
12.) In the Key Word category, you placed "factor" and "product". How are the two words different, what do they mean?
13.) In the Properties/Rules category, there are two Associative properties listed. How are they alike? What does the Associative property do?
14.) In the Properties/Rules category, there are two Commutative properties listed. How are they alike? What does the Associative property do?
15.) In the Properties/Rules category, you have placed the "order of operations". What is that? How do you remember it? Does it mean that all multiplication must be done before division or not? After all, M does come before D in PEMDAS!
16.) In the Properties/Rules category, you have placed the "order of operations". What is that? How do you remember it? Does it mean that all addition must be done before subtraction or not? After all, A does come before S!

17.) In the Parts of Polynomials category you placed "Unlike terms". How can you tell when terms are unlike?
18.) In the Math Instructions category, you placed "round". What does it mean to round a number?
19.) In the Properties/Rules category you placed the "distributive property". Can you write on the board an example of the distributive property? (You can get help from your group.)
20.) In the Math Applications category, you placed "area"

Example: Tic-Tac-Toe

Example of a tic-tac-toe format for vocabulary related to polynomials. Students write sentences connecting the three words in each row, column, and diagonal. (Students could have placed the words into different cells of the tic-tac-toe format.)

Ascending order	Constant	Monomial
Degree	Polynomial	Binomial
Trinomial	coefficient	Terms

To deepen learning from Tic-Tac-Toe…

You can have students work in pairs or groups. Once they have completed the activity, ask students to share sentences they create. Compare and contrast students' sentences with the same three words. Write the sentences on the board and ask students if one is better then another and if so, why. Encourage discussion of the sentences to help students comprehend the concepts. Students will use the textbook to find vocabulary definitions in order to summarize the information for three words into one sentence.

Example: Semantic Feature Analysis #1

(example given is from Mower, 2003)

Directions: Fill in the matrix by answering each question as it pertains to the given algebraic concept.

Equations	**Degree?**	**Number of distinct zeros?**	**Shape of graph?**	**Number of *y* intercepts?**	**Number of *x* intercepts?**
Linear					
Quadratic					
Cubic					
Polynomial	*nth*				

Example: Semantic Feature Analysis #2

(example given is from Barton & Heidema, 2002)

Directions: Place an X for each feature/property that accurately defines the given terms.

	Features / Properties				
Terms	**Diagonals are congruent**	**Diagonals are perpendicular**	**Diagonals bisect each other**	**All sides are congruent**	**All angles are congruent**
Parallelogram			X		
Rhombus		X	X	X	
Square	X	X	X	X	X
Rectangle	X		X		X
Trapezoid					
Kite		X			

Sample questions to deepen learning from Semantic Feature Analysis

For Example #1:

1.) What are the *degrees* for the different equations? How did you know the degrees?
2.) When you look at an equation, how can you tell what the degree is?
3.) How are the graph shapes for linear and cubic equations similar? How are they different?
4.) Does the degree of an equation always represent the number of y-intercepts?

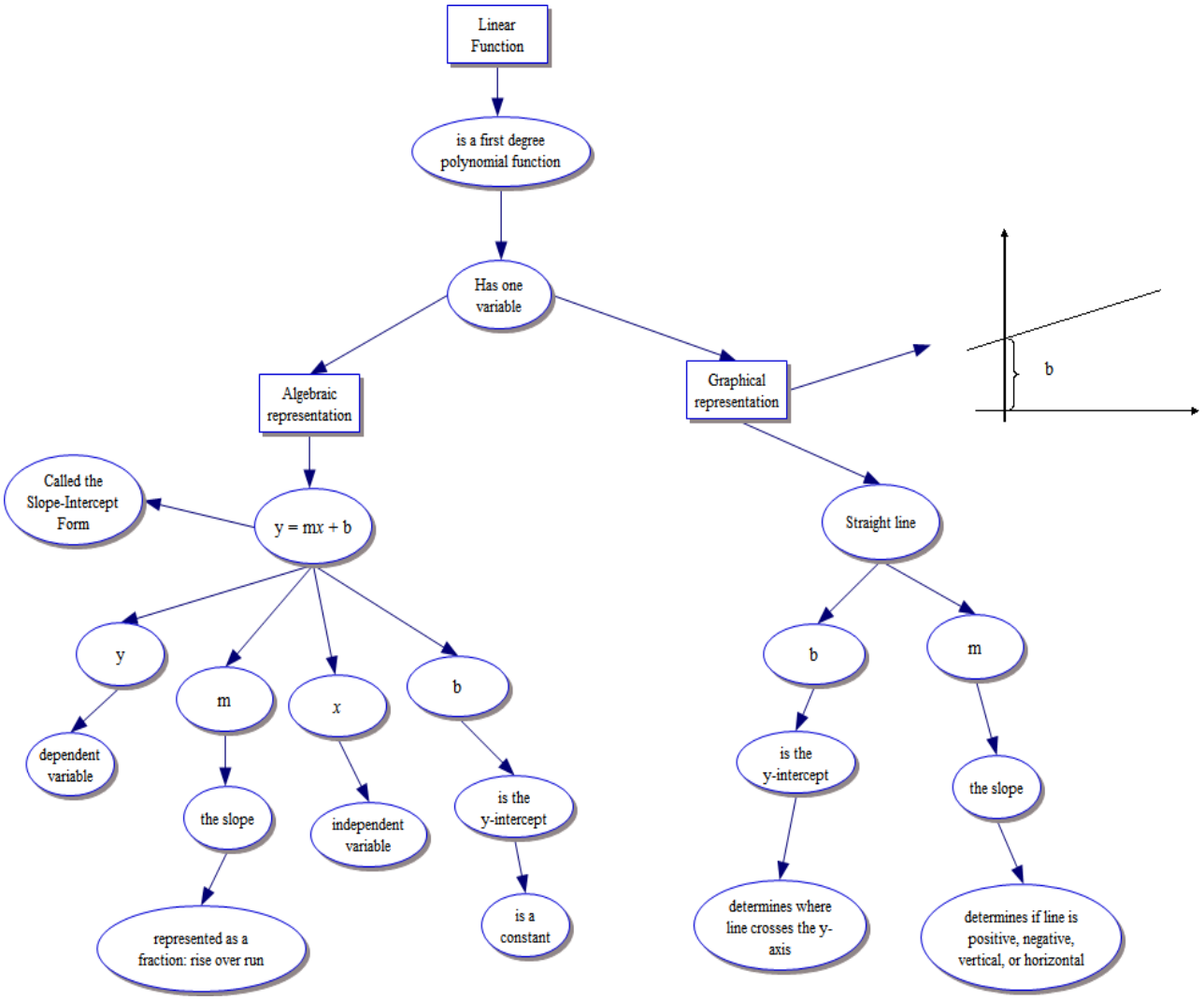
For Example #2:

1.) Let's look at the first column for *Diagonals are congruent* – what terms did you place an X? Why did you choose those terms? Does everyone agree? Anyone have any different terms X'ed?
2.) Which features/properties should be X'ed for a *Rhombus*? Anyone disagree? Why?
3.) The term congruent is used in features/properties, what does it mean? Is it always the same?

Once both examples are completed: You can ask students to write a paragraph for each row or each column or the complete table describing what is in the table. This would bring writing into the course. Students again, will use the textbook to find information to complete the table.

Example: Semantic Word Map (can be called a Concept Map)

(Modified example from Afamasago-Fuata'i, 2009)



Sample questions to deepen learning from the map

1.) What prior knowledge did you draw on to design your map?
2.) How did you decide to organize your map in the way you did?
3.) What more could you add to this map? (Looking for suggestions like drawing the 4 types of slopes, giving the slope formula and the point-slope formula, give examples of each, etc.)
4.) What other concepts does this remind you of? (Answers will depend on the level of mathematics; however for lower level mathematics students could suggest methods for solving linear equations, parallel and perpendicular lines, etc.)
5.) Are there other ways you could arrange this map? Is one way better than another?
6.) Is this a good study aid? Why or why not?
7.) Are there other representations for linear functions?
8.) Does your map cover all the key concepts for this topic?
9.) What part or parts of the map do you expect to see on the next exam? Why?

References for further information

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