## Operation

Summary
Students will learn math vocabulary.

## Materials

Chart for each operation
Doctor costume and 5-6 surgical masks for your assistants
Operation box (shoe box, shop towel, and head)
Pliers

- Operation Vocabulary Cards
- Operation Song overhead

Krypto games

- On Beyond A Million

Flip Flash Math Vocabulary
Additional Resources
Book

- On Beyond A Million
, by David Schwartz; ISBN 0440411777
- G Is for Google: A Math Alphabet Book
, by David Schwartz; ISBN 1883672589
Additional Media
- Flip Flash Math ${ }^{\text {TM }}$ Vocabulary Grades 4-5
, (available from http://www.enasco.com); Item \# TB21722T
- Krypto
®, (available from http://www.enasco.com); Item \# TB17786T


## Background for Teachers

W.F. Lindgren said, "Mathematics is a language. Reading a mathematics text is somewhat like reading Tolstoy's Anna Karenina in the original Russian. No matter how excellent the math instruction is, if the students do not know and understand the meaning of the vocabulary they will not learn what is necessary."
One of the basic skills needed to understand the meanings of the four operations is a thorough understanding of math vocabulary. Math requires a specialized set of vocabulary, just as subjects such as technology, music, art, and science do. Students must comprehend math vocabulary if they are going to be able to reason and communicate mathematically.

## Intended Learning Outcomes

1. Demonstrate a positive learning attitude toward mathematics.
2. Become mathematical problem solvers.

## Instructional Procedures

## Invitation to Learn

Dress up in a doctor costume for math class and use your acting abilities to become Dr. Mathemator-an operation specialist! Introduce your students to the vocabulary for each operation in a fun and engaging way. A suggested script is below, but use your own personality and imagination to make this work for you.
"Hello! I am Dr. Mathemator and I am ready to operate! Who was it that needed an operation? Aha! Are you the one that needs brain surgery? Over there, do you need a new liver? I know I have a spare one somewhere! Oh, you are definitely in need of $\qquad$ (looking confused) Why are you looking so puzzled and laughing at me? Am I in the wrong class? Is this not Surgery 101? What class is this? Math? Well then I am in luck, this class will be just fine for me. There are lots of operations to be done in math! You don't believe me? We might not do brain surgery, but we will do addition, subtraction, multiplication, and division, and they are all operations! So--it is time to begin! Instructional Procedures
This lesson includes vocabulary for all four operations. You would not teach these all at once, but rather teach each set of vocabulary as you introduce the operation throughout the year. After teaching each set you can also use them for a review.

Advanced preparations:
Copy the Operation Vocabulary Cards onto cardstock, cut them apart, and laminate. Put a large chart paper on the board.
Make your "Operation" box--make a head and attach to one end, cover with a blue shop towel that has a slit down the center, and place your cards in the box. (Similar to the Operation game.)
Remember to ham this up to make it fun! Use the pliers to reach into your patient (box) and search around until you find the operation sign (+-x $\div$ ). Pull it out and say, "Aha! Here is our first operation! What is it?" Place the sign on the large chart paper. "That is a fine operation! But what exactly does it do? Let's see what we can find in here to help us understand
$\qquad$ (name of operation) better." Call up some assistants, give each a surgical mask and have them reach inside patient to pull out a card. Place each card on the chart and discuss it.
Make sure students understand the "big idea" of each operation.
Addition--get them all
Subtraction--take away or compare
Multiplication--total of equal groups, repeated addition
Division--separate into equal groups, repeated subtraction
Teach students some memory devices to help them remember key vocabulary.
Journaling Activity: Write vocabulary words your students have problems with and think of memory devices to help them remember.
Addends--"Addends, addends, add them at the end" (like a jumprope rhyme).
Subtrahend--on the bottom like a submarine, crawl on floor as you repeat "I am the subtrahend, I am on the bottom."
Minuend--I am the number that gets diMINished, or made smaller. Pass out licorice sticks--have them take a bite and say I just diminished this, it is smaller."
Factor--We don't "fear factors"--they let us multiply!
Teach students the Operation Song to help them remember the meaning of each operation and the vocabulary associated with it. To help students remember the inverse operations, divide class into four parts, assign them to sing one operation's verse, then have them pair up with their inverse (addition-subtraction) (muliplication-division) and sing both verses together.
Place each of the operation signs on one wall of your room. Pass out missing operation problem cards. Have students decide which operation they would use to solve their problem and go stand under that sign. Have them solve their problems to make sure their choice is correct. Switch cards and repeat.

## Extensions

## - Vocabulary Krypto

--Play the familiar Krypto game with a twist! Students must explain their solutions using math vocabulary.
Example: I multiplied the factor 3 by the factor 8 which gave me a product of 24 . I used the divisor 6 to get the quotient 4. One bonus point is awarded for each correct vocabulary word they use.

Have advanced learners search for new and unique vocabulary words and make their own math dictionaries to write those words in. Write a sentence for each word that provides a context clue to the meaning of the word.
Example: Factor--I multiplied the factors 2 and 4 to get 8 . Students can interview older students taking advanced math classes, look on the Internet, or read books such as On Beyond a Million and $G$ is for Google.

Use Flip-Flash Math Vocabulary sets for practice and assessment

## Assessment Plan

Observing the students during the activity outlined in step 6 provides you with information about the students' level of understanding.
Make a formal written test using the missing operation problems.
Assign a problem solving activity and have students format their answers using math vocabulary and concepts.
Example: There are 36 students in our class. We need to make 9 groups. How many students will be in each group?
This is a division problem because we have a large group that needs to be separated into smaller equal groups. The dividend is 36 and we divide it using the divisor, which is 9 . The quotient is 4 , so there will be 4 students in each group.

You can adapt the math writing for students who struggle with writing by having them illustrate and label each part of the problem. Higher level students can write and solve their own problems.

## Bibliography

Research Basis
Hougue, M.D. (2003). Enriching Math Vocabulary-Measuring up to the PSSA, Slippery Rock University of Pennsylvania, Online at www.tec.iup.eud/mhougue/literary
This article discusses the premise that students lacking an understanding of math vocabulary are handicapped in their efforts to learn mathematics.
Raiker, A. (2002). Spoken Language and Mathematics. Cambridge Journal of Education.
Rubenstein, R. \& Thompson, D. (2002). Understanding and Supporting Children's Mathematical Vocabulary Development. Teaching Children Mathematics.
The previous sources were quoted extensively and provide additional information on the importance of developing strong math vocabulary skills in our students.

## Authors

$\underline{\text { Utah LessonPlans }}$

