

Teaching Students the Vocabulary of Mathematics

Mathematics is a language all its own. Its numbers, symbols, and words comprise the vocabulary students need to know to comprehend mathematical concepts. To teach vocabulary is to teach concepts. Students who know the meaning of words like *height*, *estimate*, *square*, and *equivalent*, have a language they can use to talk about these concepts. There are many effective ways to teach the vocabulary of mathematics, and thereby teach the underlying concepts.



Getting Started Find the Key Vocabulary

To find the vocabulary or concepts, skim through the textbook and the standards. There are four types of vocabulary that are considered:

- 1) *math terminology* that is unique and foundational to understand the content area (arithmetic, algebra, geometry);
- 2) *academic vocabulary* that tends to be procedural terms found across content areas (*beside*, *describe*, *graph*, *next to*, *object*, *pattern*, *solve*);
- 3) words with *multiple meanings* can lead to confusion when students only know one meaning (*foot*, *group*, *odd*, *plane*, *point*, *yard*);
- 4) *vocabulary difficulty* of the word problems and directions can make a big difference to how easily students can understand what is required. Readers may struggle to read polysyllabic words and lose track of the problem or directions.

Assess What Students Know

As teachers prepare their lessons, they make note of the vocabulary in these four categories. To assess all four types of vocabularies, teachers can ask students to list with them the terms, symbols, and operations they can think of when they first begin to study a new content area. Ideas can be global (measuring) or specific (fractions). The teacher can organize the terms hierarchically (yard, foot, inch). Teachers and students can chart these different types of vocabulary.

Activities to Teach Mathematics Vocabulary

Chart the Key Vocabulary

Charts of the vocabulary displayed prominently at eye-

level can be developed and refined. Some teachers describe these as mathematics word walls, and teachers use pocket charts for the flexibility pocket charts offer for changing math curricula and as a station for students' independent activity. Students hunt for and then chart the vocabulary they locate in their math texts. A copy of these charts can be reproduced and pasted inside the mathematics section of the vocabulary notebook. An additional column of cognates can be added for students who are learning other languages—English and Spanish, for example. Four columns might be created as seen in these examples:

Word	Symbol	Example	Spanish cognate
divide	$/ \div$	$\frac{14}{2}$	<i>dividir</i>
minus	$-$	$12 - 7$	<i>menos</i>
multiply	\times	2×3	<i>multiplicar</i>

Concept Sorts: Closed and Open

In vocabulary concept sorts, students are provided with objects, pictures, or words to sort into two to four categories, organizing them in a structure either defined by the teacher, (a *closed sort*), or developed independently by the student, (an *open sort*). Concept sorts expand students' vocabularies and their thinking.

Primary-aged children sort objects like buttons, erasers, clothes, shapes, and plastic animals into several groups by color, number, geometric shape, pattern, and holes, and use the vocabulary of mathematics to describe why they sorted the way they did.

Second graders sort and arrange objects by their weight, texture, thickness, plasticity, and they sort numbers and objects by even and odd, in groups with alternating patterns.

Fourth graders sort by various ways to measure, and sort for the components of basic formulas. The words and pictures in sorts provide support for students to explain their sorts, support particularly useful with students who are learning English.

Mathematics Vocabulary Notebooks

After explaining their sorts, students can record their sorts into their vocabulary notebooks, and they save space to add additional examples and to expand upon the patterns that they are studying. For example, next to a sequence of digits that follow an $x + 2$ pattern (3, 5, 7, 9, 11), a student created an $x + 3$ chain (4, 7, 10, 13). Students can also enter the new vocabulary in their Mathematics Vocabulary Notebooks. These pages contain symbols followed by their definitions or a figure.

Vocabulary Games

Board, card, and movement games can be made into vocabulary games. Students enjoy making and decorating the games, and they enjoy path games like a race-track game. Blank templates for board games are widely available. The playing cards and spaces on the board are based on the concept sorts and mathematical operations students have experienced. Extra playing cards can be inserted, including repeats as well as instructions to perform an operation. Ask students to read through the words in the games and expect very high accuracy. Through these games, students match numbers and the words, and they compare symbols with words.

Writing Sorts

Students often complete a *writing sort* after they've completed a closed sort. Categories are established; e.g., fractional parts: *whole, half, quarter, eighth*. As word, symbol, or fact is called out by the teacher or a partner, students listen and decide in which category each word belongs; e.g., for fractional parts: ($12/12$ (1) a whole pie; $2/4$ (0.5) half a pie; $16/64$ (0.25) a quarter of a pie; $40/320$ (0.125) an eighth of a pie. They then write the word, fraction, or symbol underneath that key label, in this example, *fractional parts*.

Related Words

In leading vocabulary activities in which students generate and study related words, teachers can infect students with their interest in words, and how mathematical concepts apply and intrigue. When students generate related words conceptually (circle, ball, planet, egg) the pace of instruction can be increased.

For students who are intermediate readers, the study of related words extends to the study of meaning or morphology, and etymology. Some of the oldest words in English come from mathematics including Indo-European, Greek, and Latin roots and origins. Words related in meaning can form another chart and ways to apply the concepts in the mathematics vocabulary. The idea of equal ($=$) is complex, and important in all social and civic studies. *Equ* from the Greek gives us *equal, equality, equalities, equations, and equanimity*. After a few examples, students will generate related words as extensions of any of these activities.

There are so many ways that math vocabulary is used. We find that intermediate readers enjoy using math symbols in their notetaking in other content areas: $+$ to link / *and*, $>$ is greater than, and \neq is *not equal to*. Mathematics has no *equal =* !

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