# VOCABULARY INSTRUCTION IN MATHEMATICS: DO THE "LITTLE" WORDS COUNT?

**KATHRYN SULLIVAN**
**Pembroke State University**

Many researchers have noted the importance of teaching students the vocabulary and concepts needed in the various content areas including mathematics. Taschow (1969) noted that Gray and Holmes found that even small amounts of direct and planned teaching of terms and concepts produced "dramatic" results in terms of comprehension and content field knowledge. John (1947) suggested that the meaning of mathematical terms such as "tangent" and "ratio" must be taught. Investigators such as Willmon (1971) and Kane, Byrne, and Hater (1974) have studied the vocabulary needed in mathematics. The emphasis of such investigators has been technical vocabulary.

Yet, as Dunlap and McKnight (1978) noted, there are three levels of mathematical vocabulary: the general, the technical, and the symbolic. The general and symbolic have been somewhat neglected. Perhaps it is assumed that knowledge of the general vocabulary will come from everyday experiences. However, Phillips (1979) noted that the correct interpretation of "little" words (from the general vocabulary class) is a major cause of difficulty in mathematics. Sullivan (1980) identified 50 words that comprised 51% of a sample of 44,394 words from selected K-6 grade mathematics texts. Most of these words represented "little" words from the general vocabulary class such as "the", "of", "to", "is", "a", "and", "in", and "at". But, does teaching students the meanings of "little" words from the class of general vocabulary enhance mathematics performance? The purpose of this study was to find out.

**Procedures**

Thirty-eight fourth, fifth, and sixth grade students attending a three week summer mathematics enrichment program served as subjects in this study. The students received mathematics instruction for two hours a day, each day of the three week period. Initially, all students were tested on mathematics computation using the *Metropolitan Achievement Test, Intermediate Level.* Based on their performance, students were assigned to one of four groups. Each group received daily instruction on mathematics computations and concepts for a period of one-half hour. Another half-hour was spent working individually on skills cards, another half-hour was spent on a fun math activity, and a fourth half-hour was spent on the control or experimental treatment. Students were assigned to the experimental or control group on the first day. Comparison of the pretest scores on the *Metropolitan* for the experimental and control groups indicated no significant difference ($t_{(36)} = .187$; NS). The pretest mean of the experimental group was 5.19 and the mean of the control group was 5.12. The control group received drill on basic addition, subtraction, multiplication, and division facts while the experimental group received instruction on the meanings of 50 vocabulary words. The words and their meanings are contained in Table 1. The meanings of the vocabulary words were discussed and recorded. Occasionally a game was played to reinforce the word meanings. Two informal tests were given to check students' retention of word meanings. The four groups rotated their activities so that during any half-hour no two groups were involved in the same activities.

On the last day of the program all students were posttested on mathematics computation. Pretest-posttest scores were compared for the entire group. Posttest scores for the experimental and control groups were also compared by means of a t-test. As suggested by Gay (1981) if groups are essentially the same on the pretest, posttest scores can be directly compared using a t-test.

**Table 1**

**VOCABULARY WORDS AND THEIR MEANINGS**

| Word | Meaning |
|---|---|
| the | one specific thing |
| is | equals |
| a | any one thing |
| are | equals |
| can | able |
| on | on top of and under |
| page | one sheet in a book |
| who | question asking about someone |
| find | figure |
| one | idea in the head that stands for more than 0 and less than 2 |
| ones | position; in a figure, the numeral to the far right |
| ten | idea in the head that stands for more than 9 and less than 11 |
| tens | position; in a figure, the numeral to the left of the ones |
| hundred | idea in the head that stands for more than 99 and less than 101 |
| hundreds | position; in a figure, the numeral to the left of the tens |
| and | something more, do both |
| or | either this or that but not both |
| number | idea in the head |
| numeral | sign or symbol used to stand for a number |
| how | question word asking for step or steps |
| many | amount, contrasted to few |
| how many | question asking for the number of something |
| what | question asking for things as opposed to persons |
| you | contrast to me, statement directed to you |
| your | contrast to mine, shows ownership |
| we | group including self, usually the subject of the sentence |
| it | contrast to he/she, in math refers to problem or thing |
| look | command to put eyes on and allow brain to react |
| write | put pencil in hand and make mark, symbol, etc. not write in cursive |
| each | every single one |
| numbers | ideas in the head |
| this | specific one in close location |
| that | contrast to this, specific but not in close location |
| set | group of things with something in common |
| us | group including self, usually the object of the sentence |
| there | contrast to here, not in close location |
| which | question that implies a choice |
| do | work or figure |
| same | alike, not different; equal in meaning |
| exercises | problems, not physical activities |
| these | contrast to those, more than one in close location |
| first | contrast to then, usually means spatial e.g. first in line; in math has to do with time e.g. do this first |
| have | contrast to have not or had, hold in one's possession |
| here | contrast to there, here is in close location |
| times | multiply; in "How many times" may mean the number of trials or performances |
| has | possession of, singular form |
| all | everything or everyone |
| equals | is, are, or the same amount on both sides |

**Results and Discussion**

Comparison of pretest and posttest scores indicated that the students as a whole made significant gains ($t_{(37)}=5.72$; $p <$ .001). The mean of the posttest was 6.6 months higher ($\overline{X} =$ 5.81) than the mean of the pretest ($\overline{X} = 5.15$). When posttest scores for the experimental and control groups were compared no significant difference was found ($t_{(36)} = .87$; NS). However, the mean ($\overline{X} = 5.98$) of the experimental group was 3.6 months higher than the mean ($\overline{X} = 5.62$) of the control group. Although not significant, a difference od 3.6 months in three weeks time seems promising. Perhaps with additional time to ensure that the meanings of the words had been mastered, gains would have been significant. This possibility is being explored in a follow-up study.

It is interesting to note that drill on basic addition, subtraction, multiplication, and division facts which many teachers believe is necessary was no more effective than vocabulary instruction in improving mathematics computation.

When the reading specialist is asked by the mathematics teachers what can be done to help students read mathematics the discussion almost always turns to word problems and ways of helping students comprehend word problems. The results of this study would seem to indicate that helping mathematics teachers *teach* their students the meanings of the "little" general vocabulary words used in mathematics textbooks and suggested in the teacher's manuals for use in presenting lessons certainly would not be detrimental to mathematics achievement. Direct instruction supplemented by discussions and games could be used.

As noted, this study is being replicated over a longer period of time to allow sufficient time to insure mastery of the words. Preliminary results indicate the experimental group has made significant gains over the control group.

Although further study is needed on a variety of populations, it appears that reading specialists may assist math teachers with more than word problems. Teaching the students the meanings of the general vocabulary used in mathematics is at least as effective as drill on basic facts and may yet be shown to be more effective.

REFERENCES

Dunlap, W. P. & McKnight, M. B. Vocabulary translations for conceptualizing math word problems. *The Reading Teacher,* 1978, *32*, 183-189.

Gay, L. R. *Educational research: Competencies for analysis & application.* Columbus, Ohio: Charles E. Merrill Pub. Co., 1981, p. 229.

John, L. Clarifying and enriching meaning vocabularies in mathematics. In W. S. Gray (Ed.), *Improving reading in the content fields.* Supplementary Educational Monograph (No. 62). Chicago: The University of Chicago Press, 1947.

Kane, R., Bryne, M.A., & Hater, M.A. *Helping children read mathematics.* New York: American Book Co., 1974.

Phillips, J. The problem with math may be "reading". *Instructor,* 1979, *89*, 67-69.

Sullivan, K.M. *An analysis of the mathematical language of selected K-6 grade mathematics texts utilizing a communication theory of language.* Unpublished doctoral dissertation, University of Georgia, 1980.

Taschow, H. G. Reading improvement in mathematics. *Reading Improvement,* 1969, *6*, 62-67.

Willmon, B. Reading in the content areas: A "new math" terminology list for the primary grades. *Elementary English,* 1971, *48*, 463-471.