

Small-Group Learning in Mathematics

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Scene I

Setting: A Math 10 class that has just been taught the concept of addition and subtraction of polynomials.

Mike: *"Mrs. M., come here. Do I have to change the signs in this one (polynomial)?"*

(Mrs. M looks at the text and sees that the question reads "sum," not "difference," as this student is suggesting.)

Mrs. M: (Pointing at the word "sum.") *"What does this word mean?"*

Mike: *"The answer."*

Mrs. M: *"And how do you obtain this answer? By doing what?"*

(Silence.)

(Other leading questions are asked, only to be met with silence.)

Mrs. M.: *"Sum means to add. Are you going to have to change the signs then?"*

Mike: *"No. I didn't know what the word meant, so I didn't know what to do. Now I can do the work."*

Oh, that this scene was simply from a book of plays rather than from our very real classroom experiences. Somehow, somewhere, our students have not been provided with sufficient experiences to read math. The students can say the words, but they can't provide a meaning for them, much less give a synonym

for a word. What then can be done to provide students with the skills necessary to read successfully in math?

This article provides some suggestions on what to do to help your students. Since word problems seem to show up a student's weakness in reading, it is within this realm that this article will be developed.

A great deal of success has been shown to occur when small-group learning is incorporated into a math classroom. The technique that I use and am most familiar with is called "Groups of Four." It is a classroom technique that allows four students to sit together, share ideas and assist each other. Using Groups of Four and the directed reading process, the teacher has a chance to teach students how to read a word problem with understanding and to develop better reading and math skills. Since this is done within the safety of a group setting, the pressure is off individual students to always know the correct answer.

The first lesson using Groups of Four is to simply have the groups read a word problem and state the question in their own words, that is, tell what they are to find. Using a very simple problem such as "Tom has four cats, Sally has three cats. How many cats do they have altogether?" one child could quietly read the problem to the group, and another child could restate the problem. By having a variety of problems ready, all of the students in the group can have a chance to assume each of the roles. Once a group is comfortable with that process, the members can create their own problems to share with other groups, then repeat the initial process.

During the initial lesson, synonyms for words such as "equal," "sum" and "difference" should be used in the problems. Exposing students to these words forces them to decide what the words mean and to learn appropriate synonyms for them. The objective

at this point is to get the students talking math, not solving it.

If appropriate, groups can also be asked to act out various problems, as one member restates the problem. Again, understanding the words and the concepts that they refer to is the objective.

The second lesson will expand upon the first and will encourage students to state what quantities are involved and what information is given in the problem. It is important that, at this stage, the groups be given problems that contain:

- a) only sufficient information
- b) insufficient information
- c) extraneous information
- d) information that has to be recalled or inferred such as, for example, the formula for perimeter
- e) information that has to be obtained from a graph or diagram
- f) information that needs to be researched

Too often, the problems that students encounter in their textbook have exactly the right amount of information and correspond exactly to what has just been studied. Thus, students are never truly forced to read the problems; they merely pick out the numbers and perform the correct operation on them, as was described in the lesson.

As the groups encounter the various types of problems, encourage the students to talk out the problems, draw pictures, act them out, and, in general, do whatever is needed to understand the problem. As the groups do this, their math, reading and language skills will be expanded. If a question requires them to do some research in the library, let them. The students need this experience, and the groups allow the students to explore in a "safe environment."

Once the students are proficient at this, encourage them to create their own problems for others to solve. The problems should require research and/or include extraneous information.

The third lesson involves having the group members discuss what process(es) is (are) to be used. Once a process is chosen, the group must be willing to support its choice. Group members may begin to observe that there are key words that, when identified, help to determine the process(es) to be used.

The nice thing about having students in groups when completing this lesson is that often there is more than one process that may be used to solve a

problem. Being in the group allows the students to see a variety of thinking strategies and processes, and, thus, individual students begin to realize that there isn't just one correct way to solve a problem.

Up to this point, there has been nothing mentioned about solving the problem. It is only after lessons one, two and three have been completed satisfactorily that you should begin having the students solve the problems. It is at this point that the students have the necessary tools to read the problem with understanding, decide what is being asked for, what quantities are involved and how to solve it.

When students have reached the fourth lesson—solving the problem—you know that you have encouraged a great deal of growth in the students' vocabularies, reading development and math skills, and that you have provided them with a comfortable setting in which to do so. (See Appendix A.)

Now, let's revisit our classroom and see how things have changed.

Scene II

Setting: Math 10 class in which groups of four are used.

Topic: Addition and Subtraction of Polynomials.

Mike: "*I see that this question says to find the sum of the polynomials. I can't remember what sum means.*"

Carla: "*I remember that. Sum is the answer when you add things.*"

Mike: "*Oh, ya! Now I remember. That means that the signs won't change inside the brackets. Hey, this is easy.*"

References

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- Sharan, S. "Cooperative Learning in Small Groups: Recent Methods and Effects on Achievement, Attitudes and Ethnic Relations." *Review of Educational Research* 50 (1980): 241-71.
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APPENDIX A

Word Problems and Directed Reading Processes

1. What is the question? What are we to find?

Have students read the question, then restate it in their own words or tell the question to a friend.

2. What quantities are involved? What is the information given?

It is suggested that students encounter problem situations with the following limitations.

Limitation	Directions to Student
• Only sufficient information	State, tell, write
• Insufficient information	Identify what is needed Supply missing information
• Extraneous information	Cross out extraneous information Reread and omit extraneous matter
• Information that has to be recalled or inferred	Supply formula Recall or infer
• Information that has to be obtained from a diagram or graph	Interpret diagram, graph or picture
• Information that needs to be researched	Use library to find information

3. What process(es) is (are) to be used?

Have students support their choice(s) of process(es). Cue words (more, less, in total, etc.) may be identified. Students may also be asked to develop related problems that are easier, similar or more difficult. Students may draw a diagram or use a more abstract representation such as a number line.

4. Can you solve the problem?

Each step of the directed reading procedure may be used as the basis of a lesson.