



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
1980 Volume VII: Problem Solving

Incorporating Word Problems Into Basic Skills Development

Curriculum Unit 80.07.01

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Introduction

This unit is concerned with practical approaches to achieving satisfaction, both among teachers and students, in the area of elementary mathematical problem solving. It presents concepts and ideas calculated to encourage educators to concentrate on, and deal with the everyday aspects of problem solving facing our students today. It is intended to be a "how to" unit. The materials and suggestions are drawn from experiences and activities of the author.

Teaching word problems and methods of solution to remedial fifth and sixth grade youngsters is a frustrating yet rewarding experience. The unit itself may be covered in as little as three weeks, or drawn out over a longer period of time. After the initial unit is completed, it is hoped the teacher will continue to dedicate at least one math period per week to the development of problem solving.

Why Don't Teachers Teach Word Problems?

Many teachers are so intent on teaching the practical aspects of mathematics and are so involved in the mechanics that they fail to realize the usefulness or the beauty of being able to apply those learned skills. It is not enough to teach five times five equals twentyfive; it has to be realized that there are practical applications and ramifications which will continue to be useful throughout the student's life.

Students in grades five, six, and seven find it difficult to adjust to word problems because they are not trained properly to deal with them. Many students who are unsure of their reading abilities assume that work problems are just too much of a hassle. It's true that if you can't read, then you can't read work problems, but that doesn't mean you can't solve them. Sometimes it takes someone to explain the mechanics of a certain problem or to review the arithmetic involved. An understanding of basic mathematical concepts is what we are looking for in preparing to teach this unit.

Problems are around us in our lives everyday. Sometimes they involve arithmetic, but most often they require a disciplined mind to set the logical order of steps before a suitable answer can be found. Arithmetic may solve some problems, but it should be emphasized that the thought process and discipline of mind that is developed through an intensified problem solving unit will be a great benefactor in setting down logical sequence and proper order in solving any related or unrelated problem.

In some cases teachers are threatened by problem solving skills because they are unfamiliar with them. If that is so, then this unit hopefully will serve to acquaint teachers with problem solving techniques.

In preparing to teach this unit it will be necessary to develop and emphasize the importance of basic skills in arithmetic. The unit is intended for use with a remedial type fifth or sixth grade class. Vocabulary for the work problems has been carefully selected to meet individual needs and abilities of the (age) group.

Each exercise will be brief specific and varied. Accuracy rather than speed will determine each student's success ratio.

Reading exercises are incorporated into the unit along with computational skills needed to solve the problems. Opportunity to apply skills will be presented but one should remember that if a student can't read the problem that doesn't necessarily mean he can't do it or lacks the math skill required.

In teaching this type of unit one should emphasize organization including accuracy, method employed, neatness, and legibility emphasis on aural skill in dealing with low readers should be considered.

Rationale

Students as well as adults are faced with innumerable problems in the course of their lives which require use of a decision making process. A problem arises and must be solved. In dealing with problems an orderly set of circumstances must be employed if the decision is to be valid.

It should include rational thinking, orderly recital of consequences and benefits, and finally a step by step account of each detail involved. To consider these facts in an analytical manner and to present a working solution to the problem at hand demonstrates pretty much how a person is dealing with life in general, for life is full of problems.

In dealing with innercity youngsters one must take into consideration the specialized problems they go through as opposed to a suburban student. Each person has problems, but for the most part they are quite different. The tools which are provided through mathematical problem solving are the same tools which will basically decide if that student will make the right decisions in becoming an acceptable, indeed a useful, member of our society.

The sole emphasis in problem solving could indeed be the dealing of verbal situations, i.e. word problems.

Hopefully when presenting this area of study, one will take into account the skills which need to be emphasized in both school (abstract) and life in general (concrete) experiences. These unique learning experiences are far more sophisticated than computational exercises generally referred to as arithmetic skills.

Generally solving problems should be broken down into three areas; understanding, thinking, and responding. The material contained may be used for individual study, team approach—that is two or more students working together, or larger group discussion and lesson. Each area is important depending on the type of students you are dealing with. Large group instruction may be broken down into small group discussion and/or individual or team instruction. A reverse process can also be employed in which individualized attempts are brought into small group discussions and finally into large group answer and methods lecture. For more information concerning these methods of instruction, read *Developmental Efforts In Individualized Learning*. (Robert A. Weisgerber, American Institutes for Research, Palo Alto, California, Editor; F. E. Peacock Publishers Itasca, Ill., 1971.)

The material enclosed in this unit may be taught as a complete foursix week unit or may be introduced for onetwo weeks and then woven into the fabric of arithmetic or a weekly basis thereafter and altered to correspond to each step taught in the mathematical sequence. Please emphasize the thinking process when presenting this material. A stepbystep approach will be very useful as a tool for students to develop. After all, we want our students to be able to develop an attitude which is coincidental with any area of problem solving. Practice in solving everyday type problems will give the student confidence to face his/her own personal situation.

Look for the problem; decide how to attack it. Make the problem real—pretend it is happening to you—put yourself in place of the person the problem talks about.

This first step is important because you need to get on the right track. Ask yourself what exactly is the problem asking for.

Example : Read all the facts, then put an X beside the questions which could be answered with those facts.

Statement : Theodore weighs 138 pounds. Since Kiddy football rules say you cannot weigh more than 125 pounds it looks as though Theodore won't play football this year.

 How much does Theodore weigh?

 Are there league rules about weight?

 Is Theodore a very tall boy?

Emphasize that the problem here is not important, but following directions is. We want to know which questions can be answered, not necessarily what the answers are.

Find the Facts. Locating the facts is an important step in solving problems. Locate all the facts in the following exercise. To help you out a bit, try retelling the problem in different words. *Think* about the question being asked. Do exactly what the directions say.

Example : In figuring his budget Mr. Smith put aside \$110.00 for fuel oil, \$25.00 for gasoline, \$140.00 for rent and \$90.00 for utilities. What was his total budget?

Fact: \$110.00 for fuel oil.

Fact: \$25.00 for gasoline.

Fact: \$140.00 for rent.

Fact: \$90.00 for utilities.

If the numbers are too large or the problems too confusing, try substituting smaller numbers for larger ones. Try re writing the problem in terms students can relate to. If problem is too easy, beef it up a bit. Make it more complex. Add different facts.

Which Tools To Use?

Before you can solve a problem you must know which tools to use. As a carpenter would choose a plane, a

saw, a nail and hammer, or a brush; a student of math must decide when to subtract, when to borrow, when to add, when to carry, when to multiply or divide. These are the basic tools. Once you have mastered them, you will use them on all of your problems.

Find the correct tool:

1. Chris had six tickets to the football game. Each ticket was stamped \$5.85. How much profit could be made by selling all six tickets?

The tool here is multiplication.

2. Angie wanted to know the difference between 330,068 and 129,878. How is this number obtained?

The tool here is subtraction.

3. Lou wanted to know how many people were in the ball park over the weekend. There were 15,526 on Friday, 11,268 on Saturday, and 27,525 on Sunday.

The tool here is addition.

4. Brian tried to find his favorite ball players batting average. He found out that he was at bat 526 times and had 187 base hits. How did he find the average?

The tool here is division.

It is important not to discourage a youngster who has trouble verbalizing or writing. The team method is a good one to employ here, because if a student has trouble stating his/her answer it can be coaxed out of him/her by a friend (teammate). In utilizing the material in this section you, as the teacher, should employ problems that relate directly to situations in the classroom or neighborhood to make things relevant. Don't take a chance on the students losing interest by dealing with problems they can't relate to. Kids at this age need excitement and stimulation. Let them help construct the problems. It is also beneficial if you have access to video tape equipment to tape this exercise and view it again at a later date so students can see how uncomfortable they were with this method of problem solving was introduced and compare it with how confident they are later in the year after all the hard work they have put into it (hopefully).

The examples here are just a guide to get you started. Feel free and confident to expand upon them yourself.

1. Jean can get a parttime job after school which pays \$3.40 per hour, but it will cost 80 cents in car fare each way. Is it more profitable for Jean to take this job or a job in the neighborhood which

pays only \$3.10 per hour but is within walking distance. Each job is for five days a week. Assume the job is for two hours a day.

How To Do It: Multiply 5 by 2 to discover that each job is 10 hours per week. The job in the neighborhood will pay \$31.00 per week ($10 \times \3.10), and the other job \$34.00 per week ($10 \times \3.40). The job out of the neighborhood will cost \$8.00, ($5 \times .80$) in car fare thus making the total salary \$34.00 minus \$4.00 or \$30.00 per week. Therefore, the neighborhood job at \$31.00 per week is more profitable even though it is for less pay.

2. Pat discovered a pocketbook in the street near the old school. In the pocketbook was \$25.00. After much thought he decided to return it to the owner but spent \$1.00 of the money for the bus fare to and from the person's house who lost it. The lady was so pleased that she gave Pat a \$5.00 reward. How much money did the lady have left?

How To Do It: She gave Pat the \$5.00 reward so subtract that from \$24.00 and you get \$19.00. Don't forget Pat spent \$1.00 on bus fare so subtract that too, thus the lady had \$19.00 left from her original \$25.00.

Math sentences are sentences written with numbers and letters instead of words. When constructing a math sentence one must be able to read it and have it make sense. Be sure to check your work and proof read it before you are finished.

1. Fran earns \$1.00 for every 20 newspapers he delivers. If he delivers 400 newspapers per week (80 per day for 5 days) how much money does Fran make? (Fran=F)

$$400 \div 20 = 80 \times 1.00 = \$80.00$$

$$F = \$80.00$$

2. Lynn bought bread, eggs, milk, and cheese. The total cost was \$4.34. How much change did Lynn get from a \$10.00 bill? (change=C)

$$\$4.34 + C = \$10.00, C = \$10.00 - \$4.34, C = \$5.66$$

Lesson Outline I

Attacking a Problem: Knowing What to Look For.

OBJECTIVE: Students will realize effectively, how important it is to know where to start when beginning a word problem.

PROCEDURE: This should be a board presented lesson. Large group instruction will tend to set everyone off in the same direction. Vary your approach depending on the personality of your class. If there is an aide or

student teacher available have that person work with individuals who normally have trouble with directions.

SUPPLIES: Notebook (spiral), pencil, and ruler.

LESSON CONTENT: Have each student copy, memorize, be familiar with, and be able to understand the following outline:

A. Attacking a Problem

1. Know what to look for.
2. Be sure to do only what the problem asks, no more, no less.
3. Don't be afraid to ask questions.

NOTE: All material should be kept in a spiral notebook. This notebook should be used for nothing else, and pages should *never* be torn out. To assure that these "rule books" will last for the duration of the unit, make sure you, as the teacher, never accept a lesson or homework paper handed in on torn out spiral paper. Also, insist on each student using a ruler to keep his/her paper neat. Underline important words on the board as you go along and expect them to do the same. Throughout the unit always insist on pencil as a writing implement so that notebooks can be erased and pages won't have to be ripped out.

EVALUATION AND NOTES

Lesson Outline II

Finding The Facts

OBJECTIVE: Individuals will realize 90100 percent effectiveness in picking facts from problems. They will realize that every fact they need to know is not always stated. Sometimes they will have to rely on facts they already know, such as measurement, et cetera.

PROCEDURE: Fact work should be presented in a team oriented approach. Arrange your class into teams of two or more participants. Do this well in advance on your own so you can avoid the confusion which inevitably results when trying to do this in class. Once teams are established present each team with two or three examples. You may use the examples in this unit and expand upon them to match your group as to level, personality, et cetera. Be flexible.

SUPPLIES: Paper, pencil, ruler, and old magazines.

LESSON CONTENT: You may wish to cut articles out of popular magazines and have students underline facts. Paste articles to 5" by 7" index cards. (For neatness use rubber cement.) This will allow students to understand what facts are and make them realize that math classes don't always have to have a lot of numbers.

NOTE: When developing teams allow nonreaders and slow readers the opportunity to be paired with faster

learners.

EVALUATION AND NOTES

Lesson Outline III

Finding The Answer

OBJECTIVE: Using the facts we have learned to find in the previous set of lessons we will now attempt to find answers to the word problems at hand. Class will perform on an 8595 percent efficiency before leaving this step.

PROCEDURE: This section should be introduced as a larger group instruction and performed on an individual basis. Each student should be given problems related to his/her own level of instruction. Level 3 examples located in this unit are the constants which could be copied and expanded upon for actual student use. Problems should be presented in class, discussed in teacher conference, and finished for homework. The results brought in each day from the night before should form the basis of your classroom discussion each day for the remainder of the unit.

SUPPLIES: Spiral notebooks, paper, pencil, scrap paper, and scissors.

NOTE: From each paper handed in there will be some examples which were done very well. Have the child cut these problems out and paste them into his/her spiral notebook. Label each of these offerings: "My Correct Problems." Do all homework and classwork assignments on scrap or regular math paper. Have each student cut out two or three examples of each correct problem for the spiral.

Stress neatness and the continuity of the lessons. Don't let a student jump ahead of their own place. Let them understand that if they are absent they will pick up where they left off, regardless of how far ahead others have moved. (See example problems when referring to specific levels.)

Lesson Outline IV

Deciding Which Tools To Use.

OBJECTIVE: To learn effectively the correct arithmetic procedures to utilize when attacking a problem in mathematics.

MOTIVATION: Demonstrate through use of pictures (magazine or curriculum) different jobs which people do in the course of a day and the tools this person uses. At the multimedia center procure a set of "people in action" pictures. They show a construction person with a jackhammer, a secretary sitting at a typewriter, a baseball player with a bat, et cetera. Demonstrate that for each task in mathematics we must *utilize* a tool. Examples should follow easily.

PROCEDURE: Demonstrate a person in a super market buying lemons which are 25 cents a piece. What tool does this person use to determine how much 9 lemons will cost? Yes, it may be addition, but wouldn't multiplication be a better and easier tool in this case? Multiplication is to addition like a power saw is to a hand saw. Use the examples in this unit as a guide and expand upon them for your group use.

NOTE: This can be a large group lesson—later with use of an aide or helper divide the large group into smaller sections for discussion.

EVALUATION AND NOTES

Lesson Outline V

Tell How To Do It.

OBJECTIVE: To be able to explain how to do a problem. To name the tools involved, the procedure and the rationale.

PROCEDURE: Briefly review the steps we have covered so far with a large group instruction session at the board. Next, break the class up into thirds. The third who are pretty much ahead may proceed onto examples, the middle third can work with an aide or student teacher while the students who are a bit lost can remain with you at the board. Give examples such as are found in this unit. Explain that we are to *tell* exactly how to do the problem in words, stopping short of actually doing the problem.

NOTE: This is a good section to incorporate into consumer education. Utilize problems which contain controversial products which students may hear about on the news or from their parents. A good topic would be beverage containers and the deposit law. You may invent addition, subtraction, multiplication, and division concerning the pros and cons of such legislation.

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