Improving Math Achievement Test Scores

By Marian Fisk

Schools are being asked to show accountability for the quality of education their students are obtaining. Teachers are evaluated as to their success in motivating and teaching children the concepts they need to know in order to achieve success in the technical society in which we live. Increasingly, the tool for measuring this learning is standardized achievement tests. If we can find a way to help students score better on these tests, then we need to discover how to do so.

In making a careful study of standardized math tests and textbooks, I found that much of what we have been teaching at early levels could wait until the child has truly mastered the basics of mathematics. To introduce concepts years before they need to be mastered only confuses children and robs them of the time they need to fully learn foundational concepts

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at earlier levels. When teachers see sixth graders still adding on their fingers, the importance of thoroughly understanding and memorizing basic calculations becomes evident.

Standardized tests make extensive use of story problems and assess the child's ability to reason and evaluate situations. If a student has an experiential understanding of math processes, he or she will be able to understand the test questions and apply the proper skill to successfully accomplish the required task. A college student I know still has not passed a remedial math course, although she has taken it several times. However, she has no trouble working with fractions because she has always enjoyed cooking and baking and has used fractions in enlarging and decreasing recipes. Methods like this, which utilize learning by doing, should be explored in every possible way in the teaching and testing of mathematics skills.

During the school year, the teacher should test the students frequently, using questions that will recall the projects in which they have participated. This will give meaning to the problems posed. If a word problem seems unclear, the student should be encouraged to manipulate objects or draw a sketch to illustrate the data given, and then seek a solution.

Techniques for Assuring Success

Achievement tests frequently include questions requiring two or more steps, as well as questions with distracting and unneeded numbers. Students need practice in dealing with these concepts as well as the opportunity to become familiar with the general format of achievement tests. Marking multiple-choice answers on a separate sheet may cause frustration for some children unless they have had experience with this type of test.

Achievement tests begin with easy problems and move on to more difficult ones. Then they go

Mastering metrics using hands-on projects

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Advantages and disadvantages of an individualized math program

Successful techniques for setting up math groups

Effective hands-on math projects

Good quality teacher education programs will produce instructors like Mr. (or Ms.) Wannateach who will in turn challenge and inspire the students in their classrooms. □

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back to easier problems. This pattern may be repeated several times. Some students give up when they encounter problems they cannot solve because they think that the rest of the test will be too difficult. Teachers should inform their students as to the way the test is organized, giving careful instructions for its completion. In addition to understanding the instructions for administering the test, teachers should read through introductory material and the test questions to anticipate any difficulty their students might have when taking the tests.

Analysis of Tests

An analysis of the Iowa Tests of Basic Skills (which is used in SDA elementary schools in the United States) shows that the mathematics test for grade three contains 90 questions. They consist of the following concepts:

Addition without carrying	10
Addition with carrying	14
Subtraction without renaming	14
Subtraction with renaming	11
Expanded numerals to 900	6
Number sentences (less than, greater than)	10

Multiplication by 2, 3, 4	11
Multiplication by 10, 100	2
Division by 2 and 3	3
Counting money (nickels, dimes, quarters)	2
Recognizing fractions (½, ⅓)	2
Telling time	1
Recognizing a square	1
Even numbers	1
Diameter of a circle	1

Examination of the list above indicates that the bulk of the test deals with addition and subtraction. It then seems advisable that beginning third graders should know from memory the addition facts to 20 and corresponding subtraction facts.

When teaching place value, expanded notation, and the writing of numerals, teachers need to word the questions in many different ways so the student becomes familiar with the terminology in standardized test questions. Some of the possibilities are listed below:

What is another way of writing 48? (40 + 8.)

How would you read 46? (Forty-six.)

How would you write 6 tens and 4 ones? (64.)

What is another name for five hundred sixty? (560.)

Which numeral tells how many tens in 90? (9.)

Which numeral is nearest in value to 699? (700 or nearest choice.)

Fourth-grade Test

The fourth-grade test has 80 questions and is made up of the following items:

Addition and subtraction	40
Multiplication by 2, 3, 4, 5, 6	14
Multiplication by 10, 100	2
Division by 2, 3, 4, 5, 9	10
Recognizing fractions	4
Expanded numerals to the thousands	6
Number sentences	9

In addition to questions similar to those on the third-grade test, there is one question for each of the following: measure of quart and gallon, finding area, recognizing a parallelogram, and choosing the right metric measure (centimeter, liter, kilogram, gram).

Fifth-grade Test

This test has 106 questions, of which 33 are addition and subtraction questions, and 23 deal with multiplication and division. Fifteen questions involve addition and subtraction of fractions. Three of these use fractions with different denominators. In addition, this test includes 11 number sentence questions and four questions with expanded numerals. Besides topics from former tests, there is one question for each of these areas: intersection (Venn diagram), naming factors and multiples, metric measure (meter, millimeter), symmetry, estimating, finding average, radius, and locating number pairs on a grid.

Sixth-grade Test

The sixth-grade test has all of the concepts in the test before it and adds the multiplying of fractions, adding and subtracting of decimals, and finding ratios. There is one question for each of these concepts: rounding numbers, percentages, interior of an angle, greatest common denominator, and the use of a negative number.

Seventh- and Eighth-grade Tests

In addition to the sixth-grade questions, the seventh-grade test includes division of fractions and the multiplication and division of decimals. There is one question for each of the following: exponents, lowest common denominator, reciprocal, bisecting an angle, measuring angles, percentage to fraction, commutative and reading base 4.

The eighth-grade test adds the following concepts to those in the tests preceding it: multiplying and dividing of decimals, changing percentage to decimal and vice versa, perimeter of an equilateral triangle, volume of a cube, and greatest possible error.

Under the section, "Nature and Purposes of the Tests," the authors of the Iowa Tests of Basic Skills make this significant comment: "Tests are aids to better instruction. As with other such aids, the usefulness of tests will depend upon the extent to which the test results are interpreted with wisdom, ingenuity, and caution. Test results should be used to supplement, not to replace, teacher judgment."

A careful study of standardized tests and a knowledge of each individual child's strengths and weaknesses in math will enable the teacher to plan sequential instruction that best addresses the child's needs and prepares him or her to participate in today's increasingly technological society. □

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the board when he solves the problem. Divide the class into three or four teams. The team that removes the most leaves for the week or the month is the winner. This helps avoid lag time with students who complete the assignment before the end of the math period.

When the season changes, replace the leaves with nuts and change the caption to "Crack the Nuts," and use more difficult problems. Snowflakes may be used with the title "Catch It If You Can," and blossoms for spring with the caption "Spring Into Math."

The teacher should assemble a collection of problems at different levels of difficulty. The section entitled "Challenge for Able Students" that appeared between 1981 and 1983 in *The Arithmetic Teacher* has excellent problems that may be used for this purpose. Students can be invited to contribute problems from their daily lives or their reading.

Life is full of problems. Everyone will surely encounter them in every part of his or her life. As teachers we must prepare our students for life—prepare them to meet problem situations and not

be overcome by them. If we have helped students not to be afraid to take risks, not to be fearful of unfamiliar tasks, not to be ashamed of failure but consider it a steppingstone to success, not to glory in success—realizing mightier tasks are ahead of them, then we will have done our part. If we have not yet totally reached our goal, we can be comforted by the knowledge that if we have done our part, the Lord will always make up for our deficiencies and fill in the gaps where we have failed. □

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indicate when to change to one-on-one instruction (10 min.).

6. When it becomes apparent that most of the students understand how to proceed, devote the remaining time to the general practice session. During this time I devote myself entirely to individualized or small-group instruction. All grading and organizational work are put aside until later.

In conclusion, you must be prepared and inspired if you expect to be able to inspire others. If you, as a role model, transmit your internal excitement about your subject