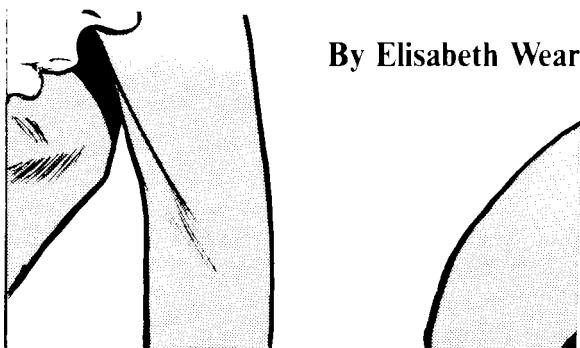


# Teacher Training— Can It Improve Elementary Math



By Elisabeth Wear

## *Monday*

**9:04** Enter Mr. Gottateach: He hurriedly writes the math assignment on the board.

**9:05** Enter 20 not-too-eager-to-learn sixth graders.

**9:10** Mr. Gottateach: "All right, settle down. Your assignment is on the board. I want you to do page 30, problems 1-20. The directions are on the top of the page. After you have read the

directions you may begin."

**9:15** Some books seem to be open. Mr. Gottateach finishes taking record and settles down to grade papers.

**9:20** Three arms are waving in the air, signaling defeat. "Mr. Gottateach, we don't know how to do this stuff."

Mr. Gottateach: "We talked about this yesterday. Read the directions; I'm not going to help you until you give this lesson a good try."

\* \* \* \*

## *Monday*

**9:00** Enter Mr. Wannateach: He writes the assignment on the board, draws a diagram of a problem to be solved and sets up the overhead projector.

**9:05** Enter 20 not-too-eager-to-learn sixth graders.

**9:10** Mr. Wannateach welcomes the class, gives an interesting five-minute introduction of the new lesson, uses several stimulus variations including working one problem on the overhead projector, asks several questions to test

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the level of student understanding, and gives students five minutes to work the first two problems.

**9:25** After circulating among the students, Mr. Wannateach sees that two points need clarification. He spends the next five minutes calling the attention of the class to the board for written clarification. Mr. Wannateach then repeats the homework assignment and gives the students the rest of the class period to complete their work. He walks among the students to see that each understands the assignment properly.

\* \* \* \*

**A**t one time in the not-too-distant past, teachers of mathematics focused primarily on the content of their subject. Classroom instruction closely resembled that described in Mr. Gottateach's class.

Today's approach to teaching differs considerably from this. In an instructional class period a teacher is expected to do the following:

1. Motivate in such a way as to focus student attention on the lesson.
2. Extend student understanding and the application of abstract ideas through the use of examples.
3. Stimulate all students to become involved in the topic.
4. Use on-the-spot evaluation techniques that help pinpoint misunderstandings of the concepts being taught.
5. Use effective ways of closing the lesson.

Methods classes, which are required for most school teaching positions, help prospective teachers learn these skills. Such classes are designed to promote effective teaching and bring about the learning outcomes that the school system desires children to achieve.

## Preparing the Preservice Teacher

Teacher education programs differ from one another in the way they prepare their students. For example, how to diagnose math difficulties may be part of a diagnostic and prescriptive teaching course or a component of a math methods course. However, the following components of a math methods course highlight important areas addressed in a typical teacher education program.

1. *Demanding proficiency in the basic mathematical skills.* Excellence in education has been the theme of almost every recent attack from kindergarten through university level. However, producing teachers with excellent mathematical skills does not necessarily mean making them take more mathematics courses at increasing levels of difficulty. Nor does it mean that math methods teachers should have to be responsible for reteaching basic skills.

Quality teacher education programs must require that students master basic skills before they enroll in methods classes. Having to pass proficiency exams before they are allowed to enroll in methods classes helps encourage college students to maintain their basic skills.

2. *Merging an understanding of developmental theories with the methods content.* Accrediting agencies usually insist that methods courses be structured so that students learn to apply developmental theories to actual classroom teaching experiences. An understanding of child development is especially important to our current beliefs about mathematics and what a child is capable of learning at certain ages.

3. *Motivating exceptional children.* Teacher education courses offered in Adventist colleges are

stressing that in church schools, as well as in public education, attention must be given to the gifted and talented student as well as the handicapped child. Although many schools lack adequate resources to address the needs of exceptional children, SDA educators are presently capable of meeting the needs of these children more completely than they have in the past.

4. *Designing an optimal educational environment.* Teacher educators have long held that preservice teachers should not only understand the process of learning, but also be able to design and adapt instructional materials to meet the needs of students of differing abilities in a variety of environments.

A teacher-in-training may have earned high grades in mathematics courses. He or she may also have taken necessary psychology classes. Yet, without a course in the methods of teaching mathematics, the new teacher will probably lack the ability to adapt math content and newly learned developmental theories into appropriate instructional materials for students.

5. *Diagnosing students' achievement levels and learning styles.* Teacher education programs help equip the preservice teacher with beginning skills in classroom diagnosis. Observation and informal testing of the child's math skills and attitudes are major functions of classroom diagnosis. Teachers-in-training are taught to make their own tests as well as interpret formal examinations, such as achievement tests.

6. *Effectively teaching mathematics to both small and large student groups.* Individualized instruction has long been stressed in teacher-education programs. Current research now reminds us  
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- The extension of ten expiring programs (such as aid for the education of adults, Indians, women, and immigrants) and an overhaul of aid to bilingual education;

- Continuation of the current eligibility standards for Pell grants to needy college students through academic year 1986-1987;

- Scholarships to attract capable students into teaching and to keep good teachers in the profession;

- Aid for magnet schools in communities undergoing desegregation;

- Creation of a Federal institution dedicated to the study of peace and conflict resolution.

#### Congress rejected:

- An effort to revamp college student aid by putting more emphasis on student "self-help" in paying tuition bills;

- A broadly drawn program of school-improvement aid;

- Legislation to improve foreign language instruction;

- A significant and very costly expansion of student aid;

- A constitutional amendment allowing organized, recited prayer in public schools;

- Structuring the public school day so as to allow moments of silent prayer;

- Reversal of *Grove City College vs. Bell* (Supreme Court, February 28, 1984), which restricted the scope of nondiscrimination laws to the particular program or activity receiving Federal funds. □

## Functional Schools Don't Just Happen

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School-building planners of the future must remember that critics persistently decry what they consider excessive outlays of money for education. Consequently, plan-

ners must examine as objectively as possible current practices in school building construction to determine whether economies can be effected.

However, school planners need to guard against being penny-wise and pound-foolish. The curriculum of the school system must determine the design of the educational plant. Efficiency in accomplishing the school's educational purpose must receive first consideration. If larger, more elaborate, and better equipped educational buildings are needed to conduct an efficient and effective educational program, then they must be provided. If, however, the educational purpose can be accomplished just as well, or better, in a more economical setting, then construction of larger, more expensive classrooms is indefensible.

If better teachers, better equipment, and better materials for instruction can be obtained through savings on school plant construction, then such savings must be made. One way of effecting optimum efficiency and economy in the future classroom may be found through a closer examination of the best and most functional utilization of classroom space. □

#### FOOTNOTES

<sup>1</sup> Stanton Leggett, C. William Brubaker, Aaron Cohodes, and Arthur S. Shapiro, *Planning Flexible Learning Places* (New York: McGraw-Hill, 1977).

<sup>2</sup> Bryce Perkins, "Team Teaching," *New Frontiers in Education*, Fred and Corrine Guggenheim, eds. (New York: Grune & Stratton, 1966).

<sup>3</sup> Francis Keppel, *The Necessary Revolution in American Education* (New York: Harper and Row, 1966).

<sup>4</sup> James A. van Zwoll, "A School Building Problem—Conserving Wealth to Improve Instruction," University of Maryland, 1960.

<sup>5</sup> Charles L. Spain, Arthur B. Moehlman, and Fred W. Frostic, *The Public Elementary School Plant* (New York: Rand McNally and Co., 1930).

<sup>6</sup> William C. Reavis, Parl R. Pierce, Edward H. Stullken, and Bertrand L. Smith, *Administering the Elementary School* (Englewood Cliffs, N.J.: Prentice-Hall, 1956), p. 417.

<sup>7</sup> van Zwoll, James A., "Classroom Area Per Pupil," Paper presented at the meeting of the American Educational Research Association (Chicago, 1963). (Mimeographed.)

<sup>8</sup> Kenneth Reid, *School Planning—The Architectural Record of a Decade* (New York: F. W. Dodge Corporation, 1951), p. 433.

<sup>9</sup> Ralph C. Daniels, "Elementary School Class-

room Area Requirements—A Study of the Relationship of the Area Per Pupil to the Achievement, Activities, Social Interactions, and Participation in Discussion of the Pupils," Ed.D. Thesis, College of Education, University of Maryland, 1966, p. 9.

<sup>10</sup> James A. van Zwoll, (Port Clyde, Maine, January 24, 1979), Interview.

<sup>11</sup> \_\_\_\_\_, "Classroom Area Per Pupil," p. 9.

<sup>12</sup> Lawrence D. Hervey, "A Survey of Classroom Space in a Selected Sample of Parochial and Private Elementary Schools," Master's Thesis, University of Maryland, 1959.

<sup>13</sup> Richard G. Stottlemeyer, "Secondary School Classroom Space Requirements—A Study to Examine Relationships Between Gross Room Area Per Pupil and Academic Achievement," Doctoral Dissertation, University of Maryland, 1965.

<sup>14</sup> Alphonse B. Gaudet, "An Experimental Exploration of the Relationship of Classroom Size to Pupil and Teacher Roles," Doctoral Dissertation, University of Maryland, 1965.

<sup>15</sup> Daniels, *Op. cit.*

<sup>16</sup> Max Rosenfeld, "Classroom Area Per Pupil and Discipline Problems: An Experimental Exploration of the Relationship of Classroom Size to Pupil Deviant Behavior and Its Management by Teachers," Doctoral Dissertation, University of Maryland, 1968.

## Teacher Training

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that instructing large groups of students is time-efficient as well as effective. Teacher-education programs strive to provide actual classroom experiences that will strengthen and expand these skills.

### On-the-Job Training

Teacher training should not—indeed, must not—end when the new teacher receives his or her diploma. In addition to good methods classes, every teacher needs the inspiration of well-conducted, meaningful in-service education provided on a regular basis.

Topics that could profitably be discussed during in-service sessions include:

Helping teachers overcome math phobia

Raising math scores on standardized achievement tests

Designing effective diagnostic classroom tests

The role of reading in elementary and secondary mathematics

Using computers in mathematics classes

Mastering metrics using hands-on projects

Using calculators: pro and con

Adapting the math program to different learning styles

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. □

## Improving Math Achievement Test Scores

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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 ( $\frac{1}{2}$ , $\frac{1}{3}$ )	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.