DOCUMENT RESUME

ED 086 560 SE 017 303

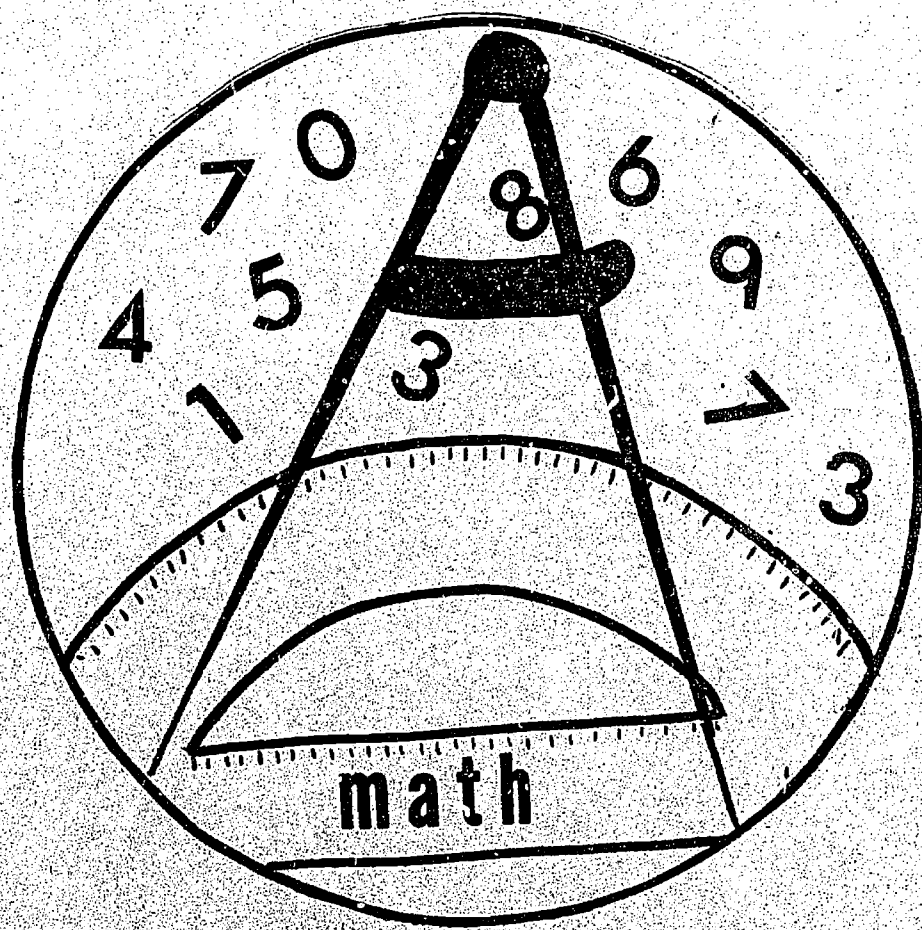
TITLE Mathematics Education: Student Terminal Goals, Program Goals, and Behavioral Objectives.
INSTITUTION Mesa Public Schools, Ariz.
PUB DATE [73]
NOTE 17p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Basic Skills; *Behavioral Objectives; *Curriculum; *Elementary School Mathematics; Instruction; Junior High School Students; *Mathematics Education; Measurement; Number Concepts; Number Systems; *Objectives; Problem Solving; Secondary School Mathematics

ABSTRACT

Behavioral objectives are listed for the primary, intermediate and junior high mathematics curriculum in the Mesa Public Schools (Arizona). Lists of specific objectives are given by level for sets, symbol recognition, number operations, mathematical structures, measurement and problem solving skills. (JP)

GOALS AND BEHAVIORAL OBJECTIVES



MESA PUBLIC SCHOOLS
Mesa, Arizona

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MESA, ARIZONA

MATHEMATICS EDUCATION

Student Terminal Goals, Program Goals, and Behavioral Objectives

Dr. George N. Smith, Superintendent

Dr. Gavin C. Humphrey, Associate Superintendent

Dr. Dell Chamberlain, Assistant Superintendent

MATHEMATICS

Terminal Goal

I. Upon completion of mathematics training in the Mesa Public Schools each student will have an understanding of sets.

Program Goal

A. Each student will understand the vocabulary and the factors involved in sets and develop skills in working with sets.

Behavioral Objectives

Primary

1. The student will demonstrate ability to recognize equivalent and nonequivalent sets by setting up a one to one correspondence between pairs of each.

2. The student will demonstrate ability to join sets by first determining the cardinal number of each set and then determining the cardinal number of the joined sets. No set on the test should have more than nine elements.

3. The student will demonstrate ability to recognize subsets as sets within a given set.

4. The student will demonstrate ability to separate sets by first determining the cardinal number of the set and the cardinal number of the subset being separated and then determining the cardinal number of the subset which will be left.

5. The student will recognize that equivalent sets can be combined by repeated addition or multiplication.

6. The student will recognize that sets can be separated into equal sized subsets by repeated subtraction or division.

Standard of performance for each item shall be 80% correct on a teacher or district constructed test of at least ten problems.

Intermediate

1. The student will demonstrate an understanding of the program objectives on sets for the primary grades. Standard of performance shall be the same as for primary students.

2. The student will demonstrate the ability to explain ratio in terms of sets.

Junior High

1. Upon completion of junior high school, the student will be able to define the following terms on a matching test and be able to graphically illustrate each term. Terms to be defined are: union of sets, subsets, disjoint sets, element of a set, empty sets, finite sets. Standard of performance will be 60% on a district prepared test.

Terminal Goal

II. Upon completion of mathematics training in the Mesa Public Schools each student will have an understanding of relations.

Behavioral Objectives

Primary

1. The student will demonstrate an understanding of the symbols $<$, $>$, $=$. He will, when given two positive integers be able to use the appropriate symbol, $<$, $>$, or $=$, to indicate their relationship.

2. The student will demonstrate an understanding that subtraction is the inverse relation to addition. He will be able to solve pairs of equations of the type $a+b=c$ and $b=c-a$.

   Standard of performance in each item shall be 70% correct on a teacher or district constructed test of at least twenty problems.

Intermediate

1. The student will demonstrate an understanding of the program objectives for the primary grades. Standard of performance shall be the same as for primary grades.

2. The student will demonstrate an understanding that division is the inverse operation of multiplication. He will be able to solve pairs of equations of the type $axb=c$ and $c \div a=b$.

3. The student will demonstrate ability to express ratio as a fraction in making comparisons between the numbers of two sets.

4. The student will be able to construct and use scale drawings in solving ratio problems.

   Standard of performance for all items shall be 80% correct on a teacher or district prepared test of at least twenty problems.

Junior High

1. The student will demonstrate knowledge of the goals on relations for the elementary grades. Standard of performance will be the same as for the elementary grades.

2. The student will demonstrate knowledge of the following symbols: $=, \neq, >, \leq, \geq, <, \approx$. Given a list of definitions, the student will match the symbols with the definitions on a district prepared test.

Terminal Goal

III. Upon completion of mathematics training in the Mesa Public Schools, each student shall have an understanding of operations.

Behavioral Objectives

Primary

1. The student will be able to solve whole number addition problems involving numbers of up to three digits and two addends, and in which regrouping is required.

2. The student will be able to solve whole number subtraction problems involving numbers of up to three digits, and in which regrouping is necessary.

3. The student will memorize the addition and subtraction facts through the fives. Standard of performance shall be 97% correct on a district prepared checksheet with a time limit of five minutes per 100 facts.

4. The student will memorize the multiplication facts through the fives. Standard of performance shall be 97% correct on a district prepared checksheet with a time limit of five minutes per 136 facts.

5. The student will be able to solve whole number multiplication problems with three digit multiplicands and one digit multipliers in which regrouping is necessary.

6. The student will be able to solve whole number division problems with one digit divisors, three digit dividends, and in which there are no remainders.

Standard of performance on all items except #3 shall be 80% correct on a teacher or district prepared test of at least twenty problems.

Intermediate

1. The student will have an understanding of the program objectives for the primary grades. Standard of performance shall be the same as for the primary grades.

2. The student will memorize the division facts through 81 ÷ 9. Standard of performance shall be no more than three errors when shown a set of flash cards at a rate of one card every five seconds.

3. The student will be able to solve whole number multiplication problems with three digit multiplicands.

4. The student will be able to solve whole number division problems with three digit divisors and six digit dividends.

5. The student will be able to solve mixed common fraction addition problems in which he must find common denominators and reduce answers to simplest form.

6. The student will be able to solve mixed common fraction subtraction problems in which regrouping and finding common denominators is necessary. Answers to be expressed in simplest form.

7. The student will be able to solve mixed common fraction multiplication problems and reduce answers to simplest form.

8. The student will be able to solve mixed common fraction division problems and reduce answers to lowest terms.

9. The student will be able to add decimal fractions in which there may be tenths, hundredths, and thousandths in the same problem.

10. The student will be able to subtract decimal fractions in which regrouping is necessary.

11. The student will be able to multiply decimal fractions.

12. The student will be able to solve decimal fraction division problems where the divisor is a decimal fraction.

Standard of performance on all tests except #2 shall be 80% correct on a teacher or district prepared test of at least twenty problems.

Junior High

1. The student will demonstrate knowledge of the goals on operations for the elementary grades. Standard of performance shall be 60% correct on a district prepared test which includes at least two examples of each of the goals.

2. The student will be able to solve addition, subtraction, multiplication and division problems in the rational number system. Standard of performance shall be 60% correct on a district prepared test with at least five problems for each operation.

3. The student will be able to convert complex fractions to simple common fractions.

4. The student will be able to convert common fractions to decimal fractions and decimal fractions to common fractions.

5. The student will be able to determine the prime factors of any natural number N. (less than or including three digit numbers) Standard of performance shall be 60% correct on a district prepared test.

6. The student will be able to solve addition, subtraction, multiplication, and division problems using decimal fractions. Standard of performance shall be 60% correct on a district prepared test with at least five problems for each operation.

7. The student will be able to convert decimal and common fractions to per cents and per cents to common and decimal fractions. Standard of performance shall be 60% correct on a district prepared test.

8. The student will be able to perform the three basic types of percentage problems. Standard of performance shall be 60% on a district prepared test.

Terminal Goal

IV. Upon completion of mathematics training in the Mesa Public Schools each student will have an understanding of mathematical structure.

Behavioral Objectives

Primary

1. The student will have an understanding of place value through four places. Given a four digit number the student will be able to give the place value for any one of the four digits.

2. The student will have an understanding of the commutative property of addition. Given a series of equations a + b = c, the student will be able to demonstrate that b + a = a + b.

3. The student will have an understanding of the associative property of addition. Given a series of equations a + b + c = d, the student will demonstrate (a+b) + c = a + (b+c).

4. The student will have an understanding of the commutative property of multiplication. Given a series of equations a x b = c, the student will demonstrate that a x b = b x a.

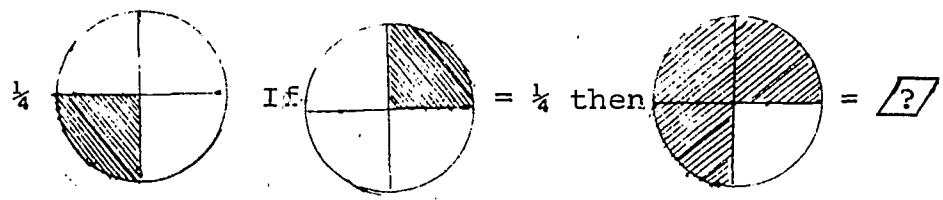
5. The student will have an understanding of the associative property of multiplication. Given a series of equations a x b x c = d, the student will demonstrate that (axb) x c = a x (bxc).

6. The student will have an understanding of the additive property of zero. Given a series of equations a + b = c where b=0, the student will be able to demonstrate that a=c or that zero is the identity number of addition.

7. The student will have an understanding of the multiplicative property of zero. Given a series of equations a x b = c where a equals any number and b=0, the student will be able to demonstrate that c=0.

8. The student will have an understanding of the multiplicative property of one. Given a series of equations a x b = c in which a is any number and b=1, the student will demonstrate that a=c or that one is the identity number of multiplication.

9. The student will have an understanding of common fractions. The student will understand the relation of halves, thirds, fourths, sixths, and eighths to one whole.



Intermediate

1. The student will have an understanding of the program objectives for the primary grades. Standard of performance shall be the same as for the primary grades.

2. The student will be able to extend the commutative and associative properties of addition to fractions. Standard of performance shall be 80% correct on a teacher prepared test of at least twenty problems.

3. The student will be able to extend the commutative and associative properties of multiplication to fractions. Standard of performance shall be 80% correct on a teacher prepared test of at least twenty problems.

4. The student will have an understanding of the property of zero in division. The student will be able to demonstrate that $0 \div 0 = 0$, where $a > 0$, and that division of any number greater than zero by zero is meaningless.

Junior High

1. The student will be able to define the real numbers, the irrational numbers, the rational numbers and the natural numbers. Standard of performance shall be to match a definition with each

of the terms with 60% correct on a district prepared test.

2. The student will have an understanding of the addition, subtraction, multiplication and division axioms for solving simple equations. Standard of performance will be 60% correct on a district prepared completion type test.

3. The student will have an understanding of the distributive property of multiplication over addition. Standard of performance will be 60% correct on a district prepared completion type test.

Standard of performance on all items except #1 shall be 80% correct on a teacher or district prepared test of at least ten problems.

Terminal Goal

V. Upon completion of mathematics training in the Mesa Public Schools, each student will have an understanding of measure.

Behavioral Objectives

Primary

1. The student will be able to tell the value of each of the following denominations of money: penny, nickel, dime, quarter, half-dollar, and dollar. Standard of performance shall be teacher orally questioning the student.

2. The student will have an understanding of the symbols for dollars and cents. Standard of performance shall be teacher observation of student when working money problems.

3. The student will be able to tell time to the minute.

4. The student will have an understanding of day, week, month and year. The student will be able to name the days of the week, in order, and months of the year, in order. He will know the number of days in a week and in a year.

5. The student will understand the following linear measures: yard, foot, inch. Given a measurement in one form the student will be able to convert it to another form.

6. The student will have an understanding of the following liquid measures: cup, pint, quart, half gallon, gallon. Given a measure in one form the student will be able to convert it to another form.

Intermediate

1. The student will be able to solve problems using linear measures of either the English system or the metric system and be able to convert measures from one system to the other.

2. The student will be able to solve problems using liquid measures of either the English system or the metric system and be able to convert measures from one system to the other.

3. The student will be able to solve problems using measures of weight of either the English system or the metric system and be able to convert measures from one system to the other.

4. The student will be able to solve problems using measures of time.

5. The student will be able to solve problems using dry measures.

6. The student will be able to find perimeters of polygons, rectangles, squares, parallelograms and triangles.

7. The student will be able to find areas of rectangles and squares.

8. The student will be able to find the volume of a rectangular solid.

Standard of performance on all items shall be 80% correct on a teacher or district prepared test of at least twenty problems.

Junior High

1. The student shall have an understanding of the program objectives on measure for the elementary grades. Standard of performance shall be the same as for the elementary grades.

2. The student will be able to determine the area of the following figures: circle, rectangle, trapezoid, triangle and parallelogram. Standard of performance will be 60% on a district prepared test.

3. The student should be able to determine the volumes of the following figures: cone, cylinder, pyramid, rectangular solid.

Standard of performance shall be 60% correct on a district prepared test.

Terminal Goal

VI. Upon completion of mathematics training in the Mesa Public Schools each student shall be proficient in the use of the tools of mathematics including mathematical discourse.

Behavioral Objectives

Primary

1. The student will be able to solve word problems in which sets are added, subtracted, multiplied or divided and which measurements may be involved. Given a word problem, the student will write the equation needed to solve the problem, solve the equation and check to be sure the solution is reasonable.

2. The student will understand the vocabulary of mathematics. He will have an understanding of the following terms: set, subset, join, element, add, addend, sum, subtract, minus, minuend, subtrahend, difference, multiply, multiplier, multiplicand, factor, product, number, numeral, parentheses, greater than, less than, equal, digit, place, linear, estimate, fractional numbers, ones, tens, hundreds, thousands, ten-thousands, hundred-thousands, millions, These terms will be taught when teaching the concepts which they represent. The teacher should be certain that these terms are understood when the concepts are developed.

Intermediate

1. The student will be able to solve word problems in which sets are added, subtracted, multiplied or divided or any combination of any of the four operations. Further, the problems may involve measures of either the English or metric systems and either common or decimal fractions. Given a word problem, the student will write the equation needed to solve the problem, solve the equation and check to be sure the solution is reasonable. Standard of performance shall be 80% correct on a teacher prepared test of at least twenty problems.

2. The student will understand the vocabulary of mathematics. He will understand the following terms: all of the terms listed on the primary grades list -

least common denominator, dividend, divisor, quotient, reciprocal, complex fraction, ratio, proportion, scale drawing, per cent, perimeter, area, volume, dimensions, cube, metric system, bar graph, line graph. These terms will be taught when teaching the concepts which they represent. The teacher should be certain that these terms are understood when the concepts are developed.

3. The student will be able to solve word problems by obtaining information from bar and line graphs. He will also be able to construct bar or line graphs from data. Standard of performance shall be 80% correct on a teacher prepared test of at least twenty problems.

Junior High

1. The student will be able to solve word problems in which sets are added, subtracted, multiplied, or divided. Given a word problem, the student will be able to write down the equation needed to solve the problem, solve the equation and check to be sure the solution is reasonable. Performance shall be 60% correct on a district prepared test of at least twenty problems.

2. The student will understand the vocabulary of mathematics. He will understand the following terms: all of the terms for the elementary grades, negative integer, positive integer, exponent, axiom, square root, reciprocal, prime number, power, repetend, circumference, chord, bisect, congruent, diameter, scientific notation. He will demonstrate it on a district prepared matching test. Standard of performance shall be 60% correct.