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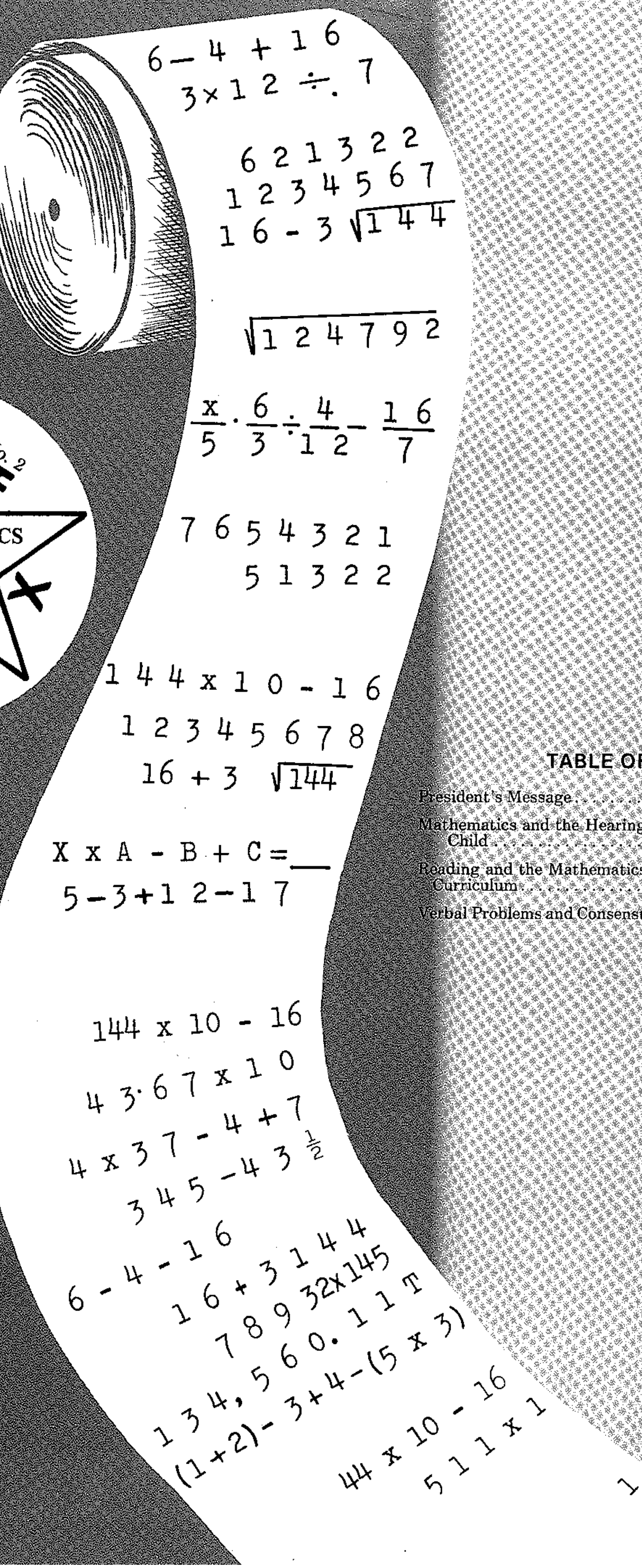

TABLE OF CONTENTS

TEXAS MATHEMATICS TEACHER is the official journal of the Texas Council of Teachers of Mathematics. The views expressed are the contributor's own and are not necessarily those of the publisher or the editor. All manuscripts and correspondence about this publication should be addressed to Mr. J. William Brown, *Texas Mathematics Teacher*, 100 So. Glasgow Drive, Dallas, Texas 75214.

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President's Message

It is a constant wonder to me how fast time passes. We are already concerned with the end of the year's activities and yet it seems the school year has just started. As Piaget reminds us, the older and busier we get, the faster we perceive time to pass.

Although Boston is a long way from Texas, I hope some of you are planning to attend the NCTM meeting which will be help there on April 18-21. There is also a Name of Site meeting being held in Shreveport on March 22-24. I urge your attendance at these meetings if possible, especially if you have never been to a Name-of-Site or national meeting. (A Name-of-Site is being planned for Dallas, March, 1980.) If you will check with your co-workers, you will find that the mathematics meetings are beneficial to your professional growth.

Plans are already underway for the annual CAMT meeting, which will be held in Austin on Oct. 25-27. I know you will want to include these dates on your fall calendar.

Betty Hall and Shirley Cousins are planning to compile another Newsletter this spring. If you have any teaching techniques you would like to share, I'm sure they would appreciate hearing from you. (Their addresses are on the inside cover.) Contributing articles to the Newsletter or to *The Texas Mathematics Teacher* is an outstanding way for you to help TCTM.

Did you know that we have less than 1000 members in TCTM? Newsletters from other states indicate they have a much larger membership than Texas. Can't we do better? Your support in recruitment of new members is a very special way in which you can help to make our organization grow. We do need your help.

Thanks again for your continued interest and support.

Anita Priest

Mathematics and the Hearing-impaired Child

Sue Boren

The University of Tennessee at Martin, Tennessee

As interest increases in the education of handicapped children, the mathematical community needs to examine the problems related to the education of these children. In particular, the education of hearing-impaired children presents special problems. Without an understanding of these problems, people in mathematics education cannot be a part of the solution. This article examines the problems in counting, place value, and terminology in the hope that mathematics educators can propose solutions.

There are several well-documented studies which show that deaf children graduating from residential schools for the deaf have an education which is at most an 8th-grade education for hearing children. Reading achievement and language development tests are consistently reported at 4th and 5th grade levels in the group of deaf children 16 years or older. [1, 5]* Since mathematics depends on language development, scores on mathematics tests are similarly affected.

One of the reasons for the low achievement is the number of "languages" which the deaf must learn. A child with a hearing impairment has at least four levels of language which must be learned.

1) Ameslan (American Sign Language)
2) SEE (Signing Exact English)
3) Lipreading or speechreading
4) Written English.

Ameslan is a shorthand language in which words are left out, and one sign may mean several different things. For example, "My name is Sue." may be signed "I, Sue." SEE is a language which stresses tenses, plurals, prefixes, and suffixes. There is still a problem with one sign having different meanings. Lipreading comprehension is estimated at 35%. This is not an effective method for learning mathematics although cued speech programs [2] may alleviate the problems of lipreading. One deaf student told me class was a waste of time if he had to depend on lipreading. Written English has a different grammar from signing and must be taught in addition to the above. For example, "wife" and "girl" are pluralized the same way in sign language, but written (and spoken) English have different rules for the plurals of these words. Then, there is the fifth level — the language of mathematics. An examination of this fifth level will be made by looking at selected topics from the elementary curriculum.

The first topic in mathematics to be considered is counting. Because of television, parents, and play-

*The numbers in brackets refer to the references listed at the end of the article.

Dates to Remember —

CAMT: **October 25-27, 1979**, Austin, Texas

NCTM Name-of-Site Meeting, **March, 1980**, Dallas, Texas mates, a hearing child *begins* school with a knowledge of letters, words, and numbers. For example, most hearing children know how to count from one to ten or even to 20 when they enter kindergarten. By the end of the third grade, counting from 1-100 is possible. To be able to count by ones from 1-100 requires names of numbers (numerals) and an understanding of place value. The repetition of sounds and the patterns of writing the words are reinforced by teachers and parents. Ginsburg [4] reports the following conversation between identical twins, Deborah (D) and Rebecca (R), who are 4 years and 11 months. Notice the interaction of the mother (M).

D: 1, 2, 1, 2, 1, 2
R: 1, 2, 3
D: No, not like that. I said 1, 2, 1, 2, 1, 2
R: 1, 2, 3, 4, 5, 6, 7, 8
D: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19
R: What's after 19?
M: 20
R: 20,21,22,23,24,25,26,27,28,29. What's after?
M: 30
R: 30,31,32,33,34,35,36,37,38,39. Now 40.
M: Good.
R: 41,42,43,44,45,46,47,48,49. (Pause) 50.
M: Good.

The interaction between Rebecca and her mother corrects mistakes and reinforces proper counting techniques. This interaction is more difficult and time consuming with the hearing-impaired child.

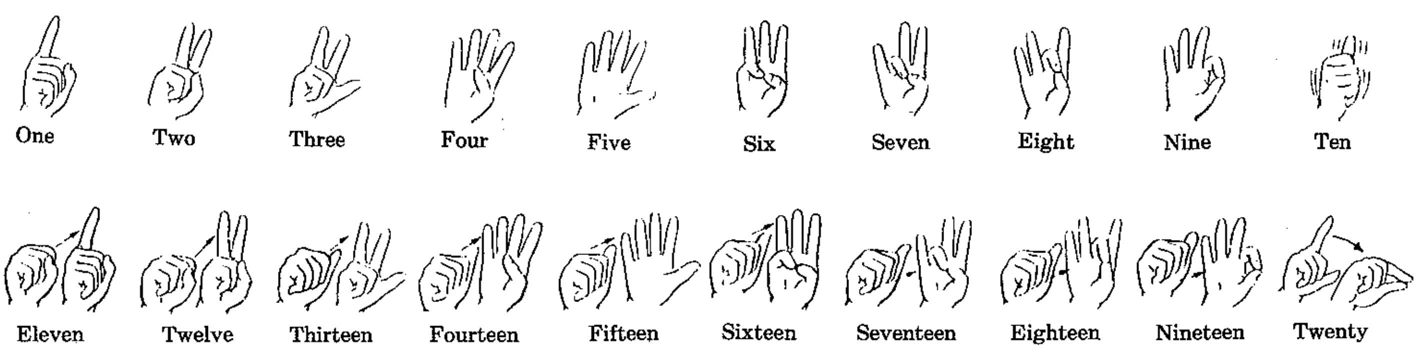
In written languages there is a pattern. The numbers 1-20 have a pattern of sound in the five languages illustrated in Table I. Eleven and twelve are unusual in all five. In English and German, 13-19 follows a pattern of 3 + 10, 4+ 10, etc. There are variations in Portuguese, French, and Spanish.

TABLE I

	ENGLISH	FRENCH	GERMAN	PORTUGUESE	SPANISH
0	ZERO	ZÉRO	NULL	ZERO	ZERO
1	ONE	UN	EINS	UM	UNO
2	TWO	DEUX	ZWEI	DOIS	DOS
3	THREE	TROIS	DREI	TRÊS	TRES
4	FOUR	QUATRE	VIER	QUATRO	CUATRO
5	FIVE	CINQ	FÜNF	CINCO	CINCO
6	SIX	SIX	SECHS	SEIS	SEIS
7	SEVEN	SEPT	SIEBEN	SETE	SIETE
8	EIGHT	HUIT	ACT	OITO	OCHO
9	NINE	NEUF	NEUN	NOVE	NUEVE
10	TEN	DIX	ZEHN	DEZ	DIEZ
11	ELEVEN	ONZE	ELF	ONZE	ONCE
12	TWELVE	DOUZE	ZWÖLF	DOZE	DOCE
13	THIRTEEN	TREIZE	DREIZEHN	TREZE	TRECE
14	FOURTEEN	QUATORZE	VIERZEHN	CATORZE	CATORCE
15	FIFTEEN	QUINZE	FÜNFZEHN	QUINZE	QUINCE
16	SIXTEEN	SEIZE	SECHZEHN	DEZESSEIS	DIEZ Y SEIS
17	SEVENTEEN	DIX-SEPT	SIEBZEHN	DEZESSETE	DIEZ Y SIETE
18	EIGHTEEN	DIX-HUIT	ACHTZEHN	DEZORTO	DIEZ Y OCHO
19	NINETEEN	DIX-NEUF	NEUNZEHN	DEZENOVE	DIEZ Y NUEVE
20	TWENTY	VINGT	ZWANZIG	VINTE	VIENTE

Methods of counting in sign language vary. Riekehof, Madsen, and Gustason use slightly different signing patterns. Madsen's signs are given in Table II. In written languages, there are ten different sounds for 1-10. However, in signing 1-10, only one hand is used. There is more similarity to base five than the base ten system. As the deaf child begins to count in kindergarten, careful development and repitition must be used.

TABLE II



Place value is essential in developing the basic facts for addition and multiplication. By combining place value and the information in Table III, one can teach the processes needed to solve the following problems.

	HUNDRED	TEN	ONE
	1	3	9
+		2	3

	HUNDRED	TEN	ONE
	1	3	9
-		2	3

	HUNDRED	TEN	ONE
	1	3	9
×		4	5

$23\overline{)1541}$

TABLE III

+	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	10
2	3	4	5	6	7	8	9	10	11
3	4	5	6	7	8	9	10	11	12
4	5	6	7	8	9	10	11	12	13
5	6	7	8	9	10	11	12	13	14
6	7	8	9	10	11	12	13	14	15
7	8	9	10	11	12	13	14	15	16
8	9	10	11	12	13	14	15	16	17
9	10	11	12	13	14	15	16	17	18

×	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9
2	2	4	6	8	10	12	14	16	18
3	3	6	9	12	15	18	21	24	27
4	4	8	12	16	20	24	28	32	36
5	5	10	15	20	25	30	35	40	45
6	6	12	18	24	30	36	42	48	54
7	7	14	21	28	35	42	49	56	63
8	8	16	24	32	40	48	56	64	72
9	9	18	27	36	45	54	63	72	81

Furthermore, an understanding of place value is essential if a child is to understand decimals. In Table IV, notice that moving left to right, one divides a given place value by 10 to get the place value of the next digit. For example, if 1 is divided by 10, we have tenths.

TABLE IV

MILLION	HUNDRED THOUSAND	TEN THOUSAND	THOUSAND	HUNDRED	TEN	ONE	•	TENTH	HUNDREDTH	THOUSANDTH	TEN THOUSANDTH	HUNDRED THOUSANDTH	MILLIONTH

Signing numbers largers than 10 deemphasizes place value for such numbers as 12 and all double-digit numbers. Some older deaf people who use a lot of home signs even sign "2-0-3" or "20-3" for "23." If "22" is signed "2-2" as we write it, then place value can be emphasized. Fingerspelling the number as well as signing would reinforce the place value.

Cuisenaire rods [3] are in ten lengths (metric system). The rods are color coded and number coded. The counting process can be taught with the rods. Emphasis can be placed on *grouping* by *tens* and therefore on *place value.* O'Neill [11] points out that deaf children must visualize concepts by manipulating objects such as beads or popsicle sticks.

As the child begins the operations, names and symbols for the operations become important. For example, "subtract," "minus," and "negative" represent different mathematical concepts. [6] Most sign books make no distinction among the three. "Times" as a synonym for "multiplied by" was indicated in only one source. "5 divides 10" and "5 divided by 10" say different things, but there is no distinction in signs. In this case, SEE can be an advantage even though the sign for "divides" is given for "divided by". [5] Greater care must be taken to develop the differences in terms so that deaf children can learn what is casually taught and reinforced in the regular classroom.

In the first grade, simple equations are solved by finding the missing addend (or term). In studying equations, the teacher begins to teach the sentence structure. By the third grade, words such as "solve" become shorthand for "find a whole number such that . . ." Translating from verbal to mathematical statements begins in the second grade. For example, "Find a number which is 4 more than 6," or "If 65 of 278 people on a plane are men, how many are women?"

The verbal meaning and the mathematical meaning are more difficult in solving the following two problems. The related mathematical equation is written below the problem.

a) If 3% of a city's population is 32500, find the total population of the city.
   $0.03y = 32500$ if y represents the total population.
b) Suppose that you have $89 in the bank. If you write one check for $99 and deposit $69, how much money will you have in the bank?
   $89 - 99 + 69 = y$ if y is the amount of money you have in the bank.

As the student studies geometric concepts which are introduced in the first grade, more and more dependence on vocabulary occurs. Distinctions are made between undefined terms such as point and definitions such as line segment. Intuitively, certain statements called assumptions are developed. Although the following assumptions may not be verbalized until junior high, the student should be familiar with them on an intuitive level.

1) A line is set which contains at least two points.
2) Two distinct points are contained in one and only one line.
3) A plane is a set which contains at least three noncollinear points.
4) Three distinct points which do not belong to the same line are contained in one and only one plane.
5) If a plane contains two distinct points of a line, then the plane contains the line.
6) If two planes have one point in common, they have a second point in common.

To convey these ideas to hearing-impaired children will require greater concentrated effort on the part of children and teachers.

Definitions which begin informally on an oral level become informal, written definitions in the third grade. The child by junior high should know the difference between the following two forms of the definition.

a) a rectangle is a parallelogram with four right angles.
b) A parallelogram with four right angles is a rectangle.

In Table V is a partial list of words necessary for mathematical study. There is a sign for each word, but there may be more than one word to each sign. There are several words such as rectangle and parallelogram which apparently have only home signs.

TABLE V

Add (SEE) [3]	Degree (SEE)	Integral (SFIP)	Reason (SEE)
Algebra (SEE)	Denominator (SEE)	Line (SEE)	Reduce (SEE)
Angle (SEE)	Describe (SEE)	Line Segment (SFIP)	Right (SEE)
Answer (SEE)	Determine (SEE)	Liter (SFIP)	Same (SEE)
Area (SEE)	Diagonal (SEE)	Mathematics (SEE)	Sentence (SEE)
Arithmetic (SEE)	Difference (SEE)	Measure (SEE)	Sequence
Ask (SEE)	Differentiate (SFIP)	Midpoint (SFIP)	Series (SEE)
Assign (SEE)	Distributive (SFIP)	Million (SEE)	Side (SEE)
Associate (SEE)	Divide (SEE)	Minus (SEE)	Similar (SEE)
Assume (SEE)	Divisor (SFIP)	Multiply (SEE)	Square (SEE)
Average (SEE)	Equal (SEE)	Negative (SEE)	Statement (SFIP)
Billion (SEE)	Equation (SFIP)	Number (SEE)	Straight (SEE)
Calculus (SEE)	Equivalence Relations (SFIP)	Numerator (SEE)	Substitute (SEE)
Cancel (SEE)	Estimate (SEE)	Parallel (SEE)	Subtract (SEE)
Center (SEE)	Even (SEE)	Percent (SEE)	Symbol (SEE)
Circle (SEE, SFIP) [6]	Factor (SEE)	Plus (SEE)	Theory (SEE)
Commutative (SFIP)	Figure (SEE)	Point (SEE)	Thousand (SEE)
Computer (SEE)	Formula (SEE)	Positive (SEE)	Triangle (SEE)
Constant (SEE)	Fraction (SEE)	Postulate (SFIP)	Trillion (SEE)
Correct (SEE)	Geometry (SEE)	Problem (SEE)	Value (SEE)
Count (SEE)	Graph (SEE)	Product (SFIP)	Vertical (SEE)
Decrease (SEE)	Horizon (SEE)	Proof (SEE)	Zero (SEE)
Define (SEE)	Hundred (SEE)	Prove (SEE)	

With the special problems of working with deaf children in such basic topics as indicated in this article, what is being done and what can be done to develop the mathematical abilities of deaf students? O'Neill's book in 1961 suggested topics that are necessary but not sufficient for today's job market. The impact of computers and the increased use of mathematical models in all areas will put pressures on schools educating the deaf to upgrade mathematical programs. To find out the current status, Johnson [7] surveyed 58 schools for the deaf and received usable information from about 80%. His survey confirmed that there is little being done in research and development of programs, materials, and methods for teaching deaf children.

Standard textbooks are written for use in a classroom where the teacher can explain to the class, drill the class, and talk with the class as students are working. The textbook assumes the child comes with a certain background. Materials need to be developed by people who teach mathematics *and* by people who teach deaf children.

Johnson's study reported little, if any, cooperation between supervisors and teachers in the selection of materials. The survey indicated that little inservice training and few mathematical professional materials were available to teachers in schools for the deaf.

Methods of instructing deaf children in mathematics have not been research according to available literature. O'Neill and Johnson both stressed the use of manipulative aids and activities. Johnson defined mathematics laboratory activities as activities designed for concept development, but not necessarily discovery activities.

If hearing-impaired children are to achieve their potential, progress must be made in mathematical education. The total curriculum K-12 must be constructed to cope with the special needs and problems of children who cannot hear. Hopefully, this discussion has triggered some interest so that mathematics educators will work more closely with educators of the deaf.

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Reading and the Mathematics Curriculum

by Dr. Marlow Ediger

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Pupils need to be ready for reading content in units of study in the mathematic curriculum. If pupils do not possess readiness characteristics, the following may well become an end result:

1. failure in achieving sequential learnings
2. not having a desire to learn
3. a lack of interest in content being presented
4. negative attitudes being developed
5. a desire to give up due to not comprehending needed ideas.

Thus, the mathematics teacher must guide pupils to become proficient readers in order to benefit optimally from ongoing units of study.

Problems in Reading Content

There are, of course, diverse problems experienced by learners in reading in the mathematics curriculum. Among others, the following may be observable:

1. early primary grade pupils experience difficulty in reading selected numbers
2. pupils on any grade level are not able to identify significant words in problem solving situations
3. a complex relationship of abstract ideas is expressed in specific word problems
4. learners encounter difficulties in extracting salient content to solve word problems
5. word calling is in evidence in oral reading of content in problem solving situations. Comprehension of ideas is thus lacking since meaning is not being attached to abstract words.
6. the reader hesitates frequently when encountering words sequentially in reading. It is difficult then to follow ideas sequentially as presented by the author.
7. the pupil substitutes words in context, thus distorting contextual situations in reading word problems.
8. a few young pupils on the early primary grade levels may read selected content from right to left instead of left to right, e.g. the symbol "$<$" means less than; a pupil having difficulties with reversal tendencies may well read the symbol as "greater than." Older learners may experience difficulty in attaching meaning to abstract symbols pertaining to ongoing units of study in mathematics.
9. selected learners lack background information to understand abstract content within the framework of word problems
10. a short attention span of individual pupils makes it difficult for these learners to gain as well as retain new ideas.

The teacher of mathematics then must be a teacher of reading. This task involves establishing objectives pertaining to reading in the mathematics curriculum. Several of these ends may well pertain to diagnosing specific problems faced by learners in reading related content.

Establishing Objectives in the Mathematics Curriculum

Careful attention must be given in choosing relevant objectives. These ends pertain to the kinds of learnings ultimately to be attained by pupils. What is relevant for learners to achieve, for example, in the reading of content in ongoing units of study in mathematics? The following, among others, may well be relevant ends for pupil achievement:

1. understanding content being read
2. separating relevant information from that of lesser importance within the framework of solving word problems
3. utilizing context clues to recognize new words
4. using phonetic analysis (associating sounds with replaced symbols) to unlock unknown words
5. dividing unknown words into manageable syllables as a word recognition technique
6. attaching meaning to structural ideas in the mathematics curriculum such as the commutative and associative properties of addition and multiplication, the distributive property of multiplication over addition, as well as the identity elements for addition and multiplication.

The teacher of mathematics also has significant goals to stress in teaching-learning situations involving reading. These include

1. stimulating learner interest in reading content in ongoing units of study in mathematics
2. helping pupils perceive purpose in learning
3. providing for pupils of diverse achievement levels so each may achieve optimal development in the curriculum area of mathematics
4. guiding learners to attach meaning to ongoing experiences
5. providing sequential experiences for pupils
6. helping pupils become proficient in problem solving
7. guiding pupils to achieve well in the affective or attitudinal dimension
8. developing needed background experiences within pupils to read new content with understanding
9. providing a variety of activities in order that diverse learning styles may receive adequate attention
10. emphasizing adequate input from learners through teacher-pupil planning.

Selected References

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Verbal Problems and Consensus

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In our modern world, new conditions, new experiences, and new information continuously emerge to require the modification of goals, policies, programs, and procedures. Importance is attached to each decision for change whether it be a one time consequence or one that will continue to affect action or reaction in the future. Training for decision-making is an important function of education. Through renewed interest in the processes whereby decisions should be made and through the re-examination of priorities in education, decision-making objectives are advancing toward integration into the educational processes at all levels of the educational hierarchy.

Verbal problem solving is generally regarded as a valuable process for educating students in the decision-making process. Devising strategies whereby verbal problem solving is retained and strengthened for educating students in decision-making while improving problem solving achievement is an integral part of mathematics education. Suydam and Weaver have stated:

> Verbal problem solving has attracted more attention from researchers than any other topic in the mathematics curriculum. It is considered a plausible way to help children learn how to apply mathematical ideas and skills to the solving of real life problems and is a challenge to both teachers and students.[1]

As educational philosophy more strongly embraces the thought that training in decision-making is fundamentally essential, verbal problem solving could become increasingly important in the formulation of mathematical curricula in modern society. Brown, D'Augustine, Heddens, and Howard have stated, "The primary purpose of word problems is to advance the children's reasoning ability and to develop skills in using mathematical concepts to solve all problems."[2] Additional support for the verbal problem approach was given by Grossnickle, Brueckner, and Rechzeh who wrote in 1968:

> Research has found that students who excel in problem solving are generally better all around students. Verbal

[1]Marilyn Suydam and Fred J. Weaver, "Verbal Problem Solving, Set B. Using Research: A Key to Elementary School Mathematics," (Princeton: Research Information Analysis Center, 1970), p. 2.

[2]Frances R. Brown, Charles H. D'Augustine, James W. Heddens, Charles F. Howard, *New Dimensions in Mathematics* (New York: Harper & Row, 1970), p. 38.

> problem solving can prepare the pupil for life beyond the elementary school. Working with a wide variety of verbal word problems helps the child to develop the ability to deal with many of the problems that arise in daily life.[3]

It appears, therefore, that the use of verbal problems as a conceptual framework to teach decision-making skills would be meritorious if approached with this particular competency as an objective. It appears also that the area of verbal problem solving may be especially conducive to the consensus strategy. Johnson has stated:

> Small group discussions have a great power especially with mathematics where topics are short. The sender gives a question to a group of receivers. The students talk it over, ask questions of each other, and explain points to each other. Each group should contain at least one 'talker' who is willing to keep conversation flowing . . . Many builders of educational taxonomies feel that most mathematical learning is learning for recall on examinations. They say that a much higher level of understanding comes when the learner can ask questions and when he can explain his idea to others. Small peer-group instruction promotes this high level of understanding.[4]

Of the various types of group activities utilized within a classroom, therefore, decision by consensus seems a favorable strategy to promote decision-making ability and to develop verbal problem solving skills. The number of skills and/or techniques utilized in the consensus strategy of instruction will vary significantly according to the composition of any given consensus group. This, however, may be good since there is some evidence to support the theory that freedom for variation of thought, ideas, and methodology may have a significant positive effect on verbal problem achievement and on attitudes toward mathematics. Buswell has stated:

> It is, of course, possible that there is a superior single formula for problem solving thinking. However, there are reasons for serious doubt that there is a single method of thinking that is universally superior, and it may be that greater success would come from broadening the search by admitting the complexity of the thinking process and attempting to identify superior ways, rather than a single way, of solving problems.[5]

In addition and incidental to primary goals, dividing the children into consensus groups to arrive at a common decision after all points of view have been heard can create good feelings in the individuals themselves and help to promote a more positive self-concept.

During the 1973-74 academic year, a doctoral dissertation study was conducted by this writer under the supervision of Dr. E. Glenadine Gibb utilizing the consensus strategy as a verbal problem teaching technique. The purpose of the study was to compare two teaching techniques called the consensus method and the expository feedback method. It compared the effects of the two methods on two identified sets of students, the consensus (experimental) set and the expository feedback (control) set in mathematics. It attempted to determine whether or not a commonly used decision-making strategy known as consensus could be incorporated into the teaching of verbal problem solving at the middle school level and produce significantly better achievement and attitudinal effects than the teacher expository method for the total sets and also for students within a group stratefied according to prior achievement in mathematics and reading.

Two sets of sixth grade mathematics students under two teachers were identified through average percentile scores in reading and modern mathematics on the Science Research Associates Achievement Tests. These sets were divided equally in number, for each teacher, into a consensus set and an expository feedback set. The consensus set was taught by the consensus set and an expository feedback set. The consensus set was taught by the consensus method and the expository feedback set by the expository method. Both sets were assessed prior to treatment for both verbal problem solving ability and attitudes toward mathematics. They were then instructed according to the particular method assigned to the set, over a ten week period of time. For each of these ten weeks, a verbal problem exercise of a different type problem description was designed for instructional purposes and presented to the students on one day per week for each week of the sequence. During the twelfth week the students were reassessed for both verbal problem solving ability and attitudes. Gains were tabulated for the two treatment groups by subgroups and by teacher. Subgroups were established according to SRA achievement scores as follows:

Subgroup	Score Average
A	03.0–34.0
B	34.1–65.1
C	65.2–96.2

Mean comparisons were made by a t-test statistical analysis. Scores were also tabulated for the two sets of students for each exercise of the ten-set problem exercise sequence and graphed for pictorial analysis of differences in rate of gain in problem solving ability over the ten week period of time.

The following conclusions were made from the study:

1. Evidence supported that achievement of students taught verbal problem solving by consensus was significantly greater than the achievement of students taught by the expository method.
2. Evidence supported that slower learners who received the consensus method treatment produced significantly greater gains in problem solving ability than those students who received the expository feedback method.
3. There were no significant differences in gains

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[3]Foster E. Grossnickle, Leo J. Brueckner, and John Reckzeh, *Discovering Meanings in Elementary School Mathematics* (New York: Holt, Winston, Rinehart, Inc., 1968, 5th ed.), p. 303.

[4]Paul B. Johnson, "Mathematics as Human Communication," in *Learning and The Nature of Mathematics*, ed. by William E. Lamon (Chicago: Science Research Associates, 1972) p. 204.

[5]G. T. Buswell, "Solving Problems in Arithmetic," *Education*, (January, 1959) p. 287.

in attitudes toward mathematics for the total sets nor for any subgroups.

4. There were no observed differences in patterns of gain from exercise to exercise for the ten-set exercise sequence between the two treatment groups and between selected pairs of subgroups.

As the search for new and better teaching strategies continues, it is hoped that further studies will be made utilizing the consensus method, and that the consensus treatment be compared, not only with expository teaching, but also with other methodologies.

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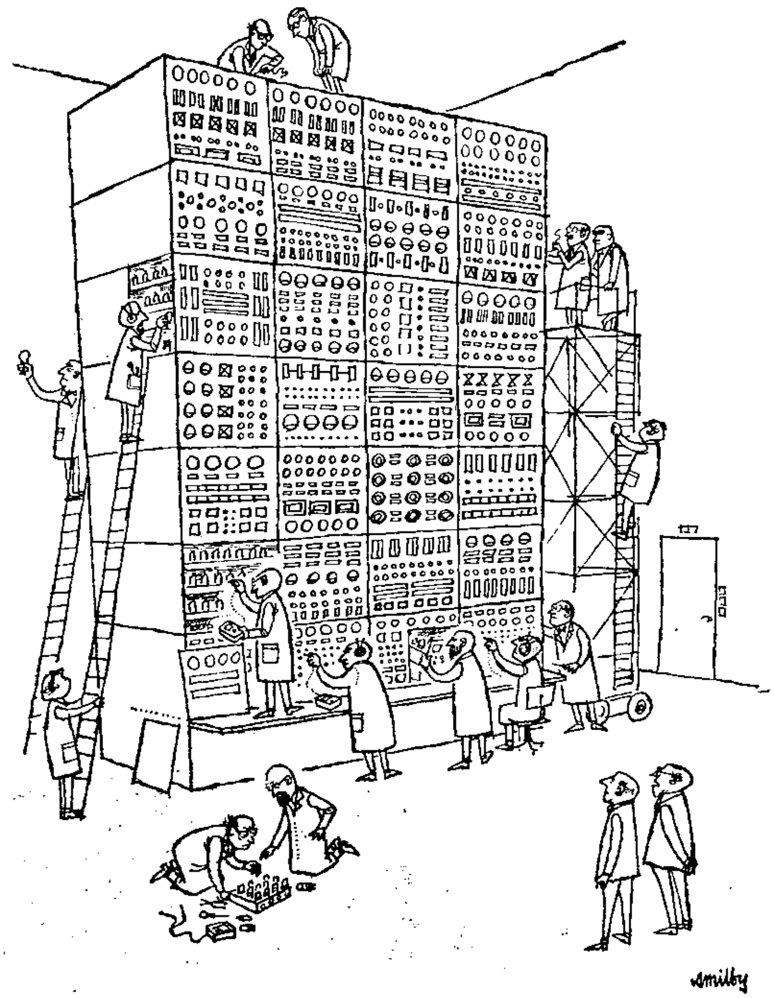

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