The following article is of special interest to teachers of elementary and junior high school mathematics.

Approaches to Teaching Percent

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"Percent", which means "per one hundred", does not need to be a difficult topic to teach in the elementary school. Coulson[1] feels that one reason for it being considered a difficult unit in the traditional math courses was because it appeared to be unrelated to previous topics. Pupils had to learn three approaches to the three types of problems. The three types of problems were, and still are today, of the following kinds:

(a) 25% of 64 is ?
(b) 16 is __% of 64.
(c) 16 is 25% of __.

However, as mathematics is taught now in the elementary grades, there are five different ways in which each type of problem can be solved. These will be discussed later.

In a meaningful mathematics program there should be continuity with new concepts developing naturally. Leslie Dwight[2] would have percent taught directly after decimals and developed from the idea of ratio of any two numbers such as $2 for a hat and $5 for a skirt. The ratio of the cost of the hat to the cost of the skirt would be 2:5 or 2/5.

Previous knowledge of working with fractions and converting to equal ratios with hundredths as the denominator are necessary for this. The important fact being brought out with this illustration is that the percent is to be related to something familiar.

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[1]W.F. Coulson, *Modern Concepts in Elementary Mathematics*, Improvement of Instruction Series No. 4, 1963, The Alberta Teachers' Association, Barnett House, Edmonton.

[2]Leslie Dwight, *Modern Mathematics for the Elementary Teacher*. Toronto, Ontario: Holt, Rinehart and Winston of Canada Ltd., 1966. No. 8, Sec. 14.

Jeanne Nelson[3] is of the opinion that percent should be introduced intuitively as early as the Grade IV level, and if done her way, the class must be familiar with the set theory of mathematics. Ratio is the relationship of a set to a set, but pupils can form rational numbers involving a subset to a set as early as Grade IV. If they have seven words right out of ten, they can figure out how many they would have had right out of one hundred. By the time they reach Grade V, they should be ready to compare two separate sets, or disjoint sets. With the previous work in Grade IV pupils should be able now to understand the difference between a subset-to-set relation and a set-to-set relation. Here again, this approach is to set the stage for the growth of percent out of a familiar background.

Grossnickle and his co-authors[4] would put the child on familiar ground by developing the idea from a ratio built around interesting topics such as *"Our team won 7 out of 10 games."*

We verbally say that "We won 7 out of 10" and write it as a fraction: 7/10, which is the decimal (decimals have presumably been taught before this) .7. Then, if 100 games had been played, it would have been 70 out of 100, 70/100, or .70.

The child would then be informed that per hundred could be called per cent and written 70%. Use of the pegboard is suggested along with this introduction. The method of solving could be any one of those which will be mentioned later.

The value of approaching the teaching of percent from a familiar starting point is stressed by Swain[5]. Assuming that the child has a working knowledge of ratios, he can work with ratios and rates to represent comparisons of "a part with a whole", hence, of a smaller number with a larger. Explain that it is convenient to express this with a MULTIPLE of 100 so that he can use the symbol % as an abbreviation for "percent" which is Latin for per centum, or out of a hundred. The familiar landmark here is the ratio which he will convert to a multiple of 100, and this will be his jumping-off spot to tackle per cent.

All these techniques are for use by teachers to ease the child into per cent. The introduction need not necessarily be preceded by decimals.

Some would advise learning percent before decimals and by using pegboards with 100 holes, teaching the pupils to compare fractions with percents. By using an overhead projector, with overlays as illustrated in Figure 1, the child can compare every ratio equivalent to 3:5 through to 60:100.

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[3]Jeanne Nelson, "Percent: A Rational Number or a Ratio", *Arithmetic Teacher*, Vol. 16, No. 2, February, 1969.

[4]Grossnickle, Brueckner, Reckzeh, *Discovering Meanings in Elementary School Mathematics*, published by Holt, Rinehart and Winston of Canada Ltd., Toronto, 5th edition, 1968.

[5]R. Swain and E. Nichols, *Understanding Arithmetic*, Chap. 6.6. Published by Holt, Rinehart and Winston of Canada Ltd., Toronto, 1966.

Figure 1

XXX 00000   XXX 00000   XXX 00000

XXX 00000   XXX 00000   XXX 00000

XXX 00000   XXX 00000   XXX 00000

XXX 00000   XXX 00000   XXX 00000

XXX 00000   XXX 00000   XXX 00000

XXX 00000   XXX 00000   XXX 00000

XXX 00000   XXX 00000

3	6	9	12	15	30	36	48	60
5	10	15	20	25	50	60	80	100

Riedesel[6] stresses the fact that there is no agreed-upon "best" method for solving percent problems, but there are indications that interrelationships between percent problems should be stressed. Having reached the point where solutions of percent problems come next, it is assumed that the children have had experience in discovery, understand the ideas of rate and ratio, and have at least some acquaintance with fractions and possibly decimals. With these facts in mind it is suggested by him that the teacher present problems to the pupil in which percent is used and follow the lead they take (if it is mathematically correct). Such a procedure is in keeping with a discovery approach, allows

[6] C. Alan Riedesel, *Guiding Discovery in Elementary School Mathematics*, Meredith Publishing Co., New York, 1967.

greater opportunity for success in handling individual differences, and makes per cent meaningful. It is presumed that the child will move into a method which is familiar to him depending on what he has learned previously. For each of the three types of problems there are five possible and acceptable ways. The manner in which they can be taught for each is described as follows:

1. THE DECIMAL APPROACH

Type A — 25% of 64 would be .25 x 64 equals ________

Type B — The child wants to know what part 16 is of 64.
He decides it is 16/64 or $64\overline{)16.00}$

Type C — He needs to find the total when 16 is 25% of the number.
In this situation he divides the number by the decimal
or $.25\overline{)16.00}$

2. THE RATIO APPROACH

Type A — 25% of 64 is ______, is written as 25/100 : n/64
He can solve this by the equivalent ratio or finding the cross product (ratio test)

Type B — 16 is ______% of 64, is written n/100: 16/24 and solved as he would any ratio problem.

Type C — 16 is 25% of ______, is written 25/100 : 16/n and solved as above

3. THE UNITARY-ANALYSIS APPROACH

Type A — To find 25% of 64, they first say 1% of 64 is .64,
so 25% is 25 x .64

Type B — To find what % 16 is of 64, they reason that if
64 represents 100%,
1 is (100/64)%, therefore, 16 is 16 x 100/64 or 25%

Type C — 25% is 16,
1% is 16/25, therefore, 100% is 100 x 16/25

4. THE FORMULA APPROACH

With this approach, each part is labelled.

Example: What is 10% of 80. Answer 8.