SOME NEW MATH IN OLD RUTS

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One of the pedagogical dangers we face in promoting new methods of teaching mathematics is that of falling into narrower and deeper ruts than our predecessors did. The temptation to immortalize a particular method that appears at first to be "the" means to an end is indeed very great. In so doing we may lose sight of many implications of the new method as well as shut out other refreshing ideas for handling the same problem.

A good example is the so-called rate-ratio method of handling percentage problems. One of the authorized texts for Alberta has accented this method to such an extent that many teachers and students alike have almost made a fetish of it. Mentioned below are some of the implications:

1. Whenever percentage problems appear, especially in the physical sciences, students begin to set up a proportional equation - almost without thinking. Unfortunately some problems do not lend themselves easily to this form of equation, and many students guess rather wildly the position of the "unknown" symbol.

2. The computational bogey of "cross multiply" is still very much with us, despite certain refinements (Comparative or Trichotomy laws of order in Rational Numbers) which only a few teachers seem to be able to get across to their classes. We still find many students "cross-multiplying" in algorithms of binary operation as well as proportional equations.

3. It would appear that many students also are so well "trained" in solving proportional equations that when they meet other types for the first time, they have no method of attack at all - for example, the $d = rt$, $V = lwh$ or $I = prt$ types. Teachers of science are especially critical of students who have been steeped in this rather singular modus operandi.

To briefly conclude what could be a rather long article, may I suggest a comparison between the rate-ratio-proportional method and *another* method in handling one of the more difficult of the three types of percentage problems.

Problem. If I still have \$50 left after having started with \$200, what % did I save?

Rate-Ratio Method. We may reduce this to the form of \$50 = n% of \$200. Thence $\frac{50}{200} = \frac{n}{100}$. Or we may symbolize the problem directly by thinking "50 per 200 is equal to n per 100". The computation to close this sentence is as follows:

$$\frac{50}{200} = \frac{n}{100}$$

$$200n = 5000$$

$$n = \frac{5000}{200} = 25$$

However simple this may seem, we find many students getting the "answer" n = 25%. This seems ample proof that the total operation has been mechanical. If the teacher insists that the student interpret the answer in the light of the original problem, one hears all kinds of agonizing sounds coming from students. In fact some teachers do not seem to realize that the "answer" n = 25% is indeed very wrong.

Another Method.

$50 = n\%$ of \$200

$50 = n \cdot \frac{1}{100} \cdot 200$ % is a special fraction $\frac{1}{100}$

$50 = n \cdot \left(\frac{1}{100} \cdot 200\right)$ Assoc of mult.

P F F Multiply but don't reduce yet

$50 = n \cdot \frac{200}{100}$ Using inverse form equation

P F F

$50 \div \frac{200}{100} = n$

$50 \times \frac{100}{200} = n$ Inverse of division

$25 = n$ Simplification

Most of the steps in the reasoning are shown here, but the student soon learns the shortcuts, based upon solid deductvie logic.

Note that the meaning of % is utilized in step 2; consequently, there is no repetition in the final result. Another advantage of this method is that only the basic *field* laws are used, and this is in keeping with the modern psychology of the "power of conceptual thinking".

However, the most important implication is that this method provides a modus operandi for a whole range of equations such as

$V = lwh$

$150 = 10.w.3$ Given V, l and h. Find w

$150 = 10.3.w$ Comm. of Mult.

P F F

$150 = 30 . w$

P F F

$150 \div 30 = w$ Inverse form of equation

etc.

May we conclude that while rate-ratio "method" of solving some problem situations is extremely useful, it can also be a narrow and even dangerous device if it becomes the only strategy.

INNOVATIVE MATERIALS AVAILABLE

Cynthia Parsons

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