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Model Teaching

One of the more imaginative of the current efforts to improve the teaching of mathematics in elementary school involves the use of a set of wooden rods of differing lengths, sometimes called Cuisenaire rods after Georges Cuisenaire, the Belgian teacher who developed them. The rods serve as a model for work in arithmetic, and certain other parts of mathematics, much as the figures sketched in high school geometry serve as models for the proofs of the theorems. Use of models in the solving of problems has an honorable place in the teaching of mathematics, not to mention the creation of new mathematical ideas. There is the pitfall in such use, however, of becoming so zealous in the manipulation of the model as to loose sight of the mathematics the model is supposed to illuminate.

The wooden rods are square in cross section, 1 cm by 1 cm. They come in ten lengths, from pieces 1 cm long through pieces 10 cm long. In teaching arithmetic, the rods could be used, for example, to represent the equation "$2 + 3 = 5$" by setting a 2-cm rod end to end with a 3-cm rod, and then covering both rods with a 5-cm rod. And the rods could be used to represent the equation "$2 \times 3 = 3 \times 2$" by placing two 3-cm rods side by side, and then covering the resulting rectangle by setting three 2-cm rods crosswise to the first rods. The children learn not only by looking at the rods and seeing that the two sides of an equation are equal, but also from handling the rods and feeling this equality.

Many other, and more ambitious, things can be done with the rods, but the problem the model poses is that even those persons who agree about its effectiveness in teaching disagree on when, for a given problem, that effectiveness ceases. Thus, in the teaching of fractions, some teachers use the rods to represent a given fraction by placing two rods in an ordered arrangement. To represent the fraction "1/2," for example, the 1-cm rod could be placed above the 2-cm rod. Other teachers find, however, that it is in just this kind of use that the rods turn from an aid to thought into a hindrance to thought.

The difficulty with this representation of fractions, it is argued, is that the model begins to lose its one-to-one correspondence with the mathematical work it is supposed to illustrate. Consider, for example, the representation of "1/2" by a 1-cm rod over a 2-cm rod and of "1/10" by a 1-cm rod over a 10-cm rod. In arithmetic there is the inequality "$1/2 > 1/10$," yet, taking the two representations together, the representation of "1/2" appears not larger, but smaller, than that of "1/10." There are now two possibilities, the argument continues. Either this lack of correspondence will confuse the child or it will not. If it confuses him, the model should be abandoned. If it does not confuse him, the model should also be abandoned, because this simply shows that the young scholar is sophisticated enough to use pencil and paper. It will not bother him that the written mark "1/10" looks larger than the written mark "1/2."

Some meaningful work with the rods can still be done on fractions. To obtain a representation of "1/4," for example, let the 4-cm rod represent "1." The 1-cm rod will then represent "1/4"—the rods are not labeled with numbers, but rods of different lengths are distinguished by different colors. The Cuisenaire rods are surprisingly helpful if used properly, but wisdom in introducing a model in teaching mathematics must be matched by equal wisdom in knowing when the model must be abandoned. In using a model, the danger lies in loving it not wisely but too well.—J.T.