

DOINGWHATWORKS



Video

FULL DETAILS AND TRANSCRIPT

Word Problems

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Topic: Response to Intervention in Elementary-Middle Math
Practice: Foundations of Arithmetic

Highlights

- Simple powerful abstract ideas in mathematics applicable to a variety of situations
- Teaching students to decide which operation applies to which types of story problems
- Examples of types of story problems for division operations
- Difficulties caused by the simplified approach of teaching keywords to identify operations

About the Interviewee

Sybilla Beckmann is professor of mathematics at the University of Georgia. She has a Ph.D. in mathematics from the University of Pennsylvania and taught at Yale University as a J. W. Gibbs Instructor of Mathematics. Dr. Beckmann has done research in arithmetic geometry, but her current main interests are the mathematical education of teachers and mathematics content for students at all levels, but especially for pre-K through the middle grades. Dr. Beckmann developed three mathematics content courses for prospective elementary school teachers at the University of Georgia and wrote a book for such courses, *Mathematics for*

Elementary Teachers, published by Addison-Wesley, now in a second edition. She is interested in helping college faculty learn to teach mathematics content courses for elementary and middle grades teachers, and she works with graduate students and postdoctoral fellows toward that end. As part of this effort, Dr. Beckmann directs the Mathematicians Educating Future Teachers component of the University of Georgia Mathematics Department's VIGRE II grant. Dr. Beckmann was a member of the writing team of National Council of Teachers of Mathematics' Curriculum Focal Points for Prekindergarten Through Grade 8 Mathematics; was a member of the Committee on Early Childhood Mathematics of the National Research Council and coauthor of its report, *Mathematics Learning in Early Childhood: Paths Toward Excellence and Equity*; and has worked on the development of several state mathematics standards. Recently, Dr. Beckmann taught an average sixth-grade mathematics class every day at a local public school in order to better understand school mathematics teaching. Dr. Beckmann has won several teaching awards, including the General Sandy Beaver Teaching Professorship, awarded by the College of Arts and Sciences at the University of Georgia.

Full Transcript

I am Sybilla Beckmann, professor of mathematics at the University of Georgia. Word problems really are the main goal of mathematics. If you think about why do we have math in the first place, it's really to be able to solve problems. The beauty of math is that we can have some rather simple, powerful ideas that are abstract to some extent but, because of their abstractness, can be applied to a wide variety of seemingly rather different types of situations. And that's an extremely powerful thing about mathematics, but it's something that all students should learn to tap into.

For students who are learning about word problems and solving word problems, it's often difficult to decide which operation to use. And perhaps there are several operations involved, but which operation applies where and to what part of the problem? And for students to be successful in solving problems, their teachers are going to need to pay direct, explicit attention to instruction on what type of problem is solved by what type of operation. So in particular, it would be a mistake for teachers simply to rush headlong into always solving a problem or demonstrating how to solve a problem without discussing how I can tell that this problem is solved by this particular operation as opposed to a different operation. Students don't always pick up on what it is that allowed the teacher to decide to make that choice that it was a division problem and not a multiplication problem or not a subtraction problem. It may be completely clear to the teacher or to older students; for younger students and students who are struggling, they really need to think through and develop some tools for making those choices.

For example, with division, what kinds of problems can that solve? Well, if we are taking some big collection of things—or it doesn't even have to be a big collection of things, some collection of things—and dividing it equally into a certain number of groups, that's one type of division problem. So, for example, we might

have 27 boys, and we are trying to put them into three equal groups to make three teams. How many boys should go in each group? That would be a simple story problem for 27 divided by 3. But another type of story problem for 27 divided by 3 would be, I have a piece of string, let's say, that's 27 feet long and I want to know how many yards long is it. Well, each yard is three feet long, so to solve that problem, I need to know how many groups of three are in 27, and that's also another type of division story problem.

For students to successfully be able to solve division problems, they will need to have the idea of what kinds of problems can be solved by division. That's one of the challenges, for students to recognize what structure that problem is falling under. And teachers will have to pay explicit attention to those different types of problems.

There is a temptation, I think, often for teachers to want to give students a simplified tool that may not be reliable, and that is the use of keywords. Keywords simply can't be a reliable way to solve problems all the time. So let me give a specific example. Let's think of a simple case. Let's say Tylishia had some stamps, and then she got 15 more stamps, and after that she had 37 stamps altogether. You can ask, how many stamps did Tylishia have at first? Students who hear the words *altogether* and *more than* in that problem statement will be tempted, if they are taught to use keywords, to add the numbers 15 and 37, whereas if you think about the structure of the problem, there is an amount, there is an additional amount, and then there is that total. Well, we have to take that additional amount away from the total in order to determine the initial amount. So there is no substitute for actually understanding and making sense of that problem statement, and that might occur with the aid of some simple drawings or some kind of visual to support an understanding of that, but the use of keywords in particular is not reliable.