Mathematical Knowledge for Teaching

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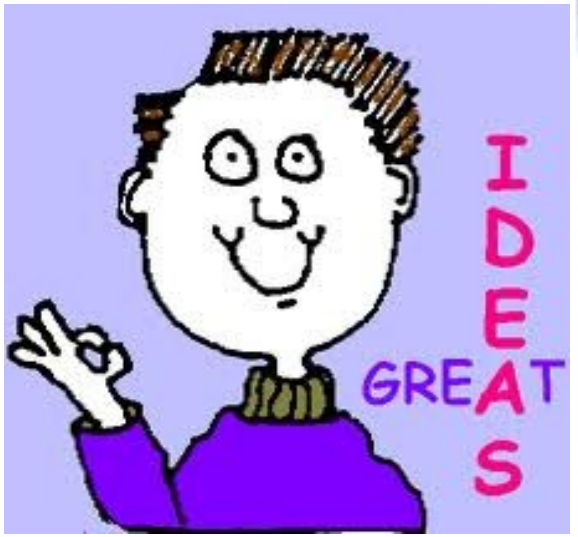
Problem to be analysed



123
× 645
615
492
+738
1845

What is the problem with this response?

How will you correct this response?

Teachers' Response 1

- I would say the students don't have an idea of, they really don't understand place value. They don't understand the concept, because they're going 4 times 3, which is what that looks like, but you have got to take it as 40 times 3 and they are not understanding that. That's why they are not placing things accordingly... The problem is that they did not see how each number is established.
- I'd already showed them that they're not just putting it (the zero) there, that there is a reason because that number is really 4,920, not 492 moved over.

Consider these ways...

123	123	123	123	123
x645	x645	x645	x645	x645
615	492	492	738	738
738	615	738	492	615
492	738	615	615	492
79335	79335	79335	79335	79335

Consider these ways...

75 X 28 600 1500 2100	75 X 28 600 150x 2100	75 X 28 40 560 100 1400 2100

Which method should be used to multiply any two whole numbers?

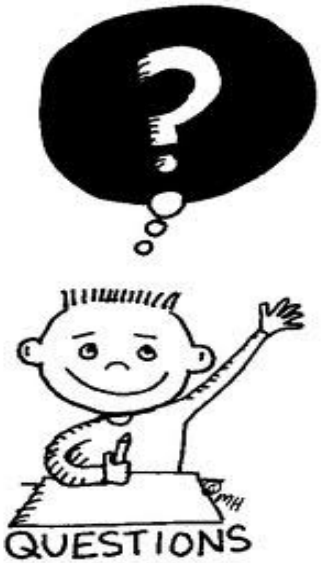
Some Questions

$$\begin{array}{r} 4.5 \\ \times\ 2.1 \\ \hline 45 \\ +\ 900 \\ \hline 9.45 \end{array}$$

Why should we multiply before adding?

$$\begin{array}{r} 4.5 \\ +\ 2.1 \\ \hline 6.6 \end{array}$$

How to decide the decimal place?



Analysing responses

$$\begin{array}{r} 2.4 \\ \times\ 1.5 \\ \hline 2.\ 20 \end{array}$$

How do we understand these responses?

$$\begin{array}{r} 2.\ 5 \\ \times\ 1.\ 8 \\ \hline 160 \\ +\ 65\ \ \\ \hline 810 \end{array}$$

Let's reflect

- Is the knowledge of the procedures sufficient for teaching mathematics?
- What will we define as 'content knowledge' in mathematics?
- How do we make sense of children's responses?

What kind of knowledge is required for teaching?

Subject Matter knowledge

- Defining accepted truths + explain why
  - Relationships within and across a discipline
  - Conditions under which a proposition is true
- Forms of representation of ideas
  - Analogies, explanations, examples
  - Level of difficulty of topics
  - Student's conceptions and their influence
- Curricula, topics, level, instructional materials

Teacher Response 2

- The problem is that the student did not have a clear idea of why the numbers should be lined up in the way seemingly different from that in addition. The lining up is actually derived through several steps. First, I will put on the board an equation and work it through with students:

$$123 \times 643 = 123 \times (600 + 40 + 5)$$

$$= 123 \times 600 + 123 \times 40 + 123 \times 5$$

what allowed us to transform the problem? The distributive law. Then, I will suggest that the class rewrite the equation into columns. I will ask students to observe the zeros in the equation as well as those in the columns. Do they affect the sum? Why yes, and why no? Can the zeros in the equation be eliminated? How about zero in the column? If we erase the zeros in the columns, what will happen? Then I will erase the zeros in the columns, what will happen? Then I will erase the zeros in the column and we will get staircase-like columns on the board

Sources of SMK

- Ask *why* for procedures
- Discover patterns and relationships
- Careful selection of problems for teaching
- Learn from classroom experience
- Value students' responses/ thinking
- Analysing and discussing errors
- Thinking and understanding concept related problems and strategies

Identifying learning opportunities

mathematics for teaching
+
classroom experience
+
reflection