Math Perspectives
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Parent Letter

Shared by our associate Marilynn Magnani of Newark, DE

Dear Parents,

I want to share some observations I have made while listening to your children talk about their math. By listening to them explain their work I can better understand what sense they are making of our number system and how it works. I particularly want to talk about how your children make sense of computation and what supports sense making and what interferes with it.

Many of us think that children aren't able to add, subtract, multiply or divide unless they are taught the standard algorithm or procedure for those operations. Therefore, we try to teach the procedures first before we let the children compute. Faced with a problem like 6 x $4.95, we feel compelled to teach the standard algorithm for multiplication. How else will a child be able to find the answer?

In fact, children can carry out all kinds of computation without formal procedures and in so doing learn crucial information about our number system, information which allows them to make great sense out of their number work.

An algorithm can be very useful as a short cut for recordincomputation on certain problems. But, because it is a short cut, an abbreviated or coded form of the operations, it is very abstract. Think about learning the algorithm for long division or where to put the zeroes as place holders in double digit multiplication. In most cases, the algorithms make very little sense to children and so they struggle to memorize them without thinking about the actual numbers they are computing.

When algorithms are taught too soon, they interfere with how children make sense of numbers. The importance is shifted from number sense to memorization of seemingly unrelated procedures. Not surprisingly, many children lose what understanding they have because of the belief that the algorithm is the only right way to get the answer. There develops an over reliance on the procedure and thus an inability to discern when other strategies would be more efficient.

Rather than develop mathematical flexibility we do the opposite, and, to add insult to injury, we have children practice these procedures over and over in the name of mastery. My question is, mastery of what? Certainly we don't want them to master something which interferes with understanding.

Students need to be given many experiences which help them develop their own understanding of numbers and operations. They need to use what they truly understand about numbers to help them solve new, more complicated problems. And we have to give them the opportunity to do this.

This doesn't mean that we cast them out with no support or guidance. It does mean that we listen carefully to their reasoning, help them clarify their thoughts and lead them toward greater understanding and efficiency.

I'd like to describe two examples from the class room. These are not isolated examples. First, let's go back to the multiplication problem above, 6 x $4.95. One child, who relied on the algorithm to get the answer, often became confused as to which place to put the numbers and then what to do with the decimal point. When I asked her if she had an estimate of what the answer might be she told me that she couldn't tell until she was done. However, I knew that this child had decent number sense and in other cases, without relying on the algorithm, she would have been able to figure out the answer with ease.

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Parent Letter (cont.)

Another child changed the $4.95 to $5.00 multiplied to get $30.00 and then took away the extra 30 cents. She did this in a minute's time. She was able to do this because she was thinking about what those numbers meant. Right away she knew that the answer was going to be a little less than $30.00.

The next example concerns the "long division" algorithm, second only to the algorithm for dividing fractions, in its ability to obscure number sense. In the traditional algorithm students are taught to Divide, Multiply, Subtract and Bring Down (There are countless mnemonics used to help remember the order, one being, Does Mac Donald's Serve Burgers? I'm not even going to go down that road.)

One student set up the problem, 126 divided by 15, in the long division form. Before he began, I asked him if he had an estimate of what the answer might be to which he replied, "No." I then asked him what it meant to divide and he said that it meant to do what he was doing, and he indicated the problem he was working on. He then began the procedure by saying, "Fifteen goes into 14, zero times, I think. But no, I'm supposed to divide first. So 15 divides into 14 once and now I'm supposed to either subtract or multiply." I stopped him at this point and asked if he could tell me in words what the problem was asking and he said he wasn't sure but he thought it meant 15 divided by 126.

I could go on, but I hope I have made my point. This child was very confused and I believe much of it had to do with his determination to remember the steps of the procedure rather than trying to understand what was being asked.

Another child in the class approached this problem by thinking about how many groups of 15 could be made from 126. Right away he said it couldn't be 10 because you would need 150 for that. He then used the multiples of 15 he knew, and wrote down, 4 15's = 60, so 8 15's = 120. The answer is 8 groups of 15 with 6 left over.

When students have been given time to develop a solid understanding of numbers and operations using their own strategies, algorithms can be learned and applied when useful. They can be looked at from a different perspective, one which includes an understanding of why they work. Then, and only then, is the student master of the procedure rather than the other way around.

If we teach our children tricks such as, when you multiply by 10, add a zero or add two zeros when you multiply by 100, we are inadvertently supporting the notion that math is done without meaning. If we want our children to be powerful mathematically, they deserve more than tricks. They deserve the time to build an understanding about our base 10 number system so that they know what it means to multiply by 10, or a hundred or .1 (one tenth). This is truly powerful.

Building a solid understanding of numbers, takes time. Often we feel rushed and want to push the process along. We want to show our children the "quick" way of getting an answer. Our children become masters of nodding their heads when we say, "Do you get that? Now do you see? Just put the zero over here because now you're multiplying in the 10's place. Understand?" as we quickly jot down our solution.

Allow your children to solve problems their way even if it seems terribly inefficient. Ask them to explain their reasoning and listen to their explanations. They are learning about how to work with numbers and most important, they are doing it in a way that makes sense to them. As they do this, their understanding grows and they are able to use this understanding in a very powerful way.