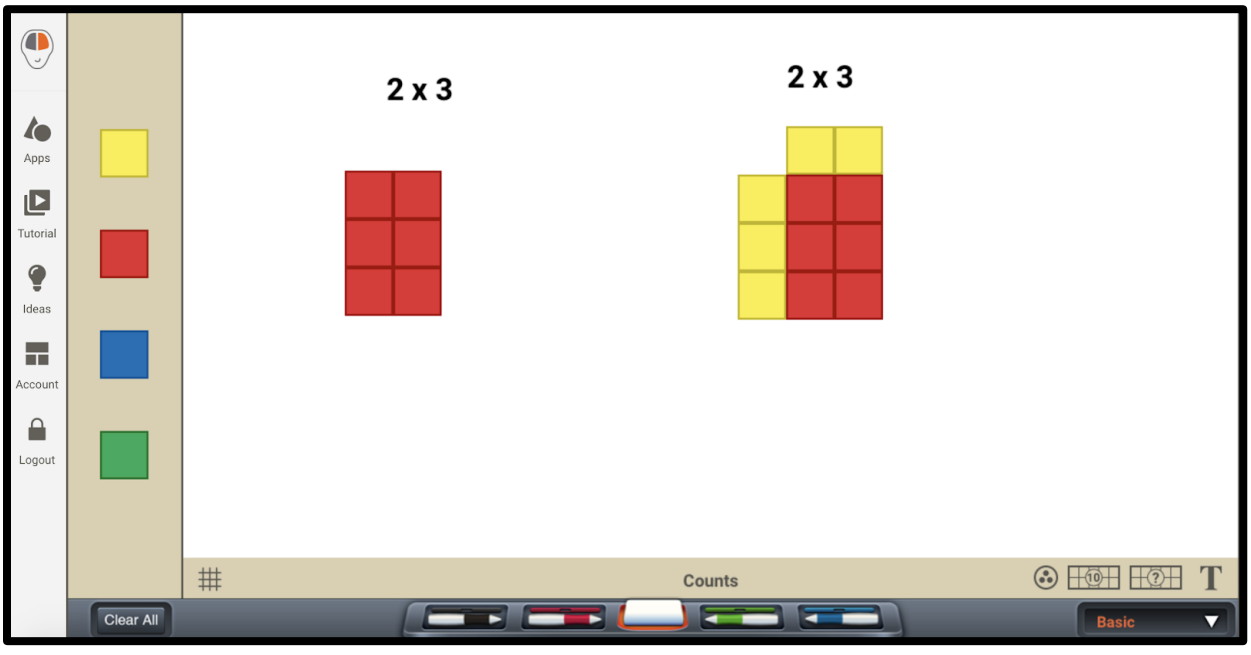
Building Conceptual Understanding with Manipulatives: Part II

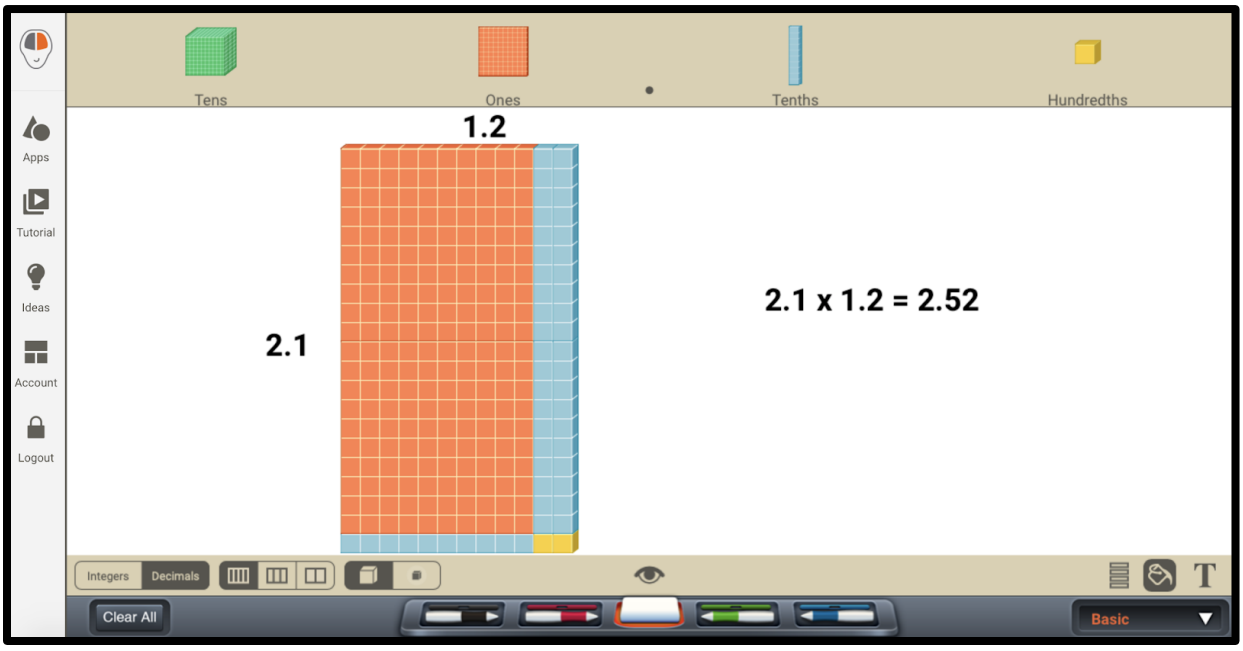
Kevin Dykema, Mattawan Consolidated Schools
kdyema@mattawanschools.org

Last month we looked at building conceptual understanding of multiplying two 2-digit numbers through using manipulatives. This month, we'll look at what could come before to build up to this concept as well as how this can be applied to higher grades, again using manipulatives.

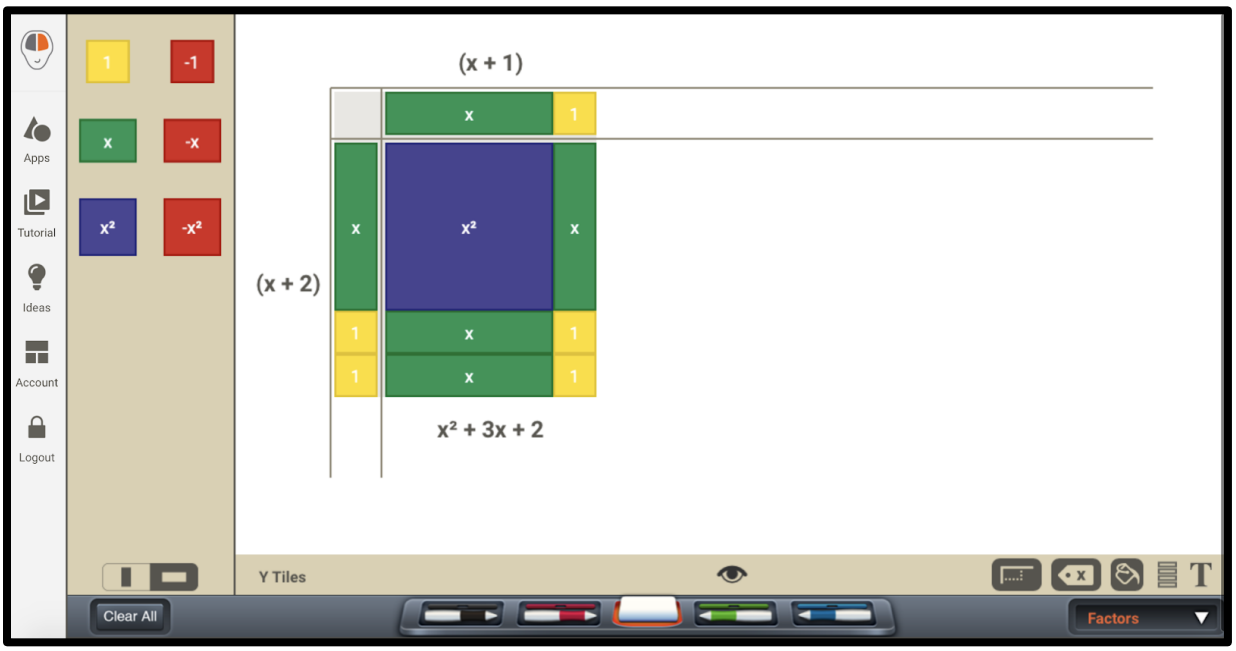
We can begin by examining multiplying two 1-digit numbers. Many of us may have learned multiplication as repeated addition. This, however, is just one model for multiplication- another is by looking at an area model. For example, we can look at 3 x 4 using Color Tiles, as shown below. The images throughout were created using www.brainingcamp.com. They offer free trials of their 16 web-based virtual manipulatives.



At times, it may be helpful to highlight the factors, as indicated by the image below. This may help some students more clearly see the 2 and the 3. Students can count to see that the product is 6. This area model can then be extended to two-digit numbers, as we looked at last month. If we use our Base Ten blocks in a slightly different way, we can extend this area model even further and begin to look at decimals, as shown below. Using the Base Ten blocks with decimals can help reinforce to students that ten 1/10's is a whole and ten 1/100's is a tenth and many students begin to see how the "decimal numbers" are related to the whole numbers and help solidify their understanding of place value.



However, the area model doesn't stop at decimals; it can be used with multiplying fractions as well as multiplying integers and binomials. Many of us learned to multiply binomials by "FOILing". I now cringe at this as I've come to realize that FOIL really requires the students to do quite a bit of memorizing to get the answer and then multiplying a binomial by a trinomial is a completely different topic/procedure for them. I'd much rather them continue building area models, utilizing Algebra Tiles (or some other similar manipulative) to develop a good conceptual understanding.



After students have created several models, they generally begin to notice that there are four "sections" to the product rectangle – a section with the x^2's, a section with horizontal x's, a section with vertical x's, and a section of the units. Just as with multiplying two-digit numbers, we can use this noticing as well as some questioning and students develop an understanding that multiplying two binomials is really the Distributive Property, just extended. This recognition of the extended Distributive Property can then be utilized to multiplying a binomial by a trinomial or other such multiplying polynomial problems. No longer are students having to memorize steps.

As teachers, we need to take the time to help our students develop good conceptual understanding of the concepts. We need to look for professional development and resources to help us develop that solid understanding so that we can continue to help our students appreciate the beauty of mathematics.