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Learning Outside the Rules: Lessons from the Past

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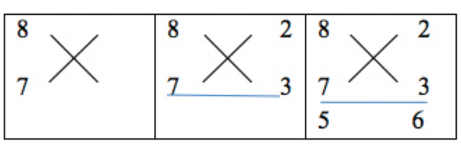
Recently, I had the opportunity to work with a group of young adults to explore the history of mathematics. One of the participants became intrigued with the concept of multiplication and we spent many afternoons discussing how the Egyptians, Babylonians, Mayans, Romans, and other civilizations might have approached that operation. Along the way we explored place value and different number systems. As a future math teacher interested in working with special-needs children she was seeking a deep understanding of the concepts of multiplication rather than just procedural knowledge.

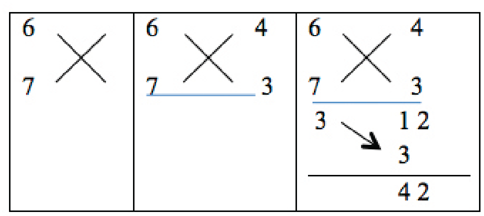
Historically, mathematics was typically taught as a set of rules and procedures. Robert Recorde wrote, *The Grounde of Arts: Teaching the Worke and Practise of Arithemticke, Both in Whole Numbers and Fractions* in 1543, which is one of the first books on mathematics printed in English. At the time, counting boards were used for computing products. Recorde felt that the products of the small digits (under 5) were simple and easy to find but offered an alternative method for the greater digits (those above 5). Eagle provides a copy of Recorde's work and the following example to find the product of 8 and 7. It might take you a few times to work through and get adjusted to the format, but I promise you the effort will be worth it.

Write the digits in a column and draw a cross. Then look at how each digit differs from 10 and write those values to the right of each number (here the differences are 2 and 3). Find the product of the differences (both small digits) and record it under the differences. To finish the problem Recorde writes "then I must take one of the differences…from the other digit (not from his own) as the lines of the cross warn me and this which is left must I write under the digits." The product of 8 x 7 is 56.



Recorde goes on to say this process will work for any digit greater than 5 so I shared this process with a few elementary students and we soon ran into problems with the process. What happens when the product of the two differences is greater than 10? In the example we had the product of differences (2 and 3) was a single digit but when we tried 6 x 7 our differences were 4 and 3 yielding the two digit product 12. Our first attempt at using Recorde's approach yielded answer of 312 which the students recognized as an unreasonable answer but not having access to the full text we had to "fix" the process on our own.

Our question was why does the process work for 8 and 7 but not 6 and 7? It took some time to explore that question. Algebraically we could have approached the product of 8 and 7 by writing 8 as 10-2 and 7 as 10-3: (10-2) x (10-3) = 100 – 20 – 20 + 6 = 56 but it is unlikely most of Recorde's readers in the 1500's had that background. So the challenge became to create a process that works for all digits greater than 5. Recognizing the place value issues and that the 5 in the example represented 50, the students arrived at this modification of Recorde's approach. The students had found success.



Time spent exploring long-abandoned methods of multiplication can provide the opportunity for rich discussions on the concepts involved along with the opportunity for students to see mathematics as a continually evolving field. Try this idea and others like it with your students, who will value their efforts more than simply solving problems with "the answers in the back of the book." **THP**

> **MVLTIPLICATION**
> **"For the fmal digettes under 5, it were but folly to teach any rule, feyng thei are fo easy, yt every child can doo it."**
> **— R. Recorde**

Resources

Visit: http://www.maa.org/publications/periodicals/convergence/counting-boards-a-counting-board-in-a-strasbourg-museum
Eagle, M. R. (1995). *Exploring mathematics through history*. Cambridge, England: Cambridge University Press.