

# IT WORKED!

## *A Ready Resource for Representation*

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### **A Ready Resource for Representation: Using LMR (*Learning Mathematics through Representations*) to Emphasize the Importance of the Number Line in 2<sup>nd</sup> through 4<sup>th</sup> Grades**

Last year, while co-teaching with a new 4<sup>th</sup>-grade teacher at my school and mentoring a new 2<sup>nd</sup>-grade teacher, I discovered a resource that I hoped would fill a gap that existed in our instruction of whole numbers and fractions, focusing on the number line as a valuable representation.

Coincidentally, at the math support teacher meeting the previous week, my colleagues (all elementary math coaches in our county) and I had had a lengthy discussion of whether we were encouraging students to use the open number line too soon as a tool for adding and subtracting whole numbers. Our conversation then moved to examining the sequence by which we move students from using a number line already partitioned into equal intervals to an open number line. One idea mentioned was Cathy Fosnot's use of unifix cubes, comprised of two interchanging colors of 5 cubes, to use as concrete anchors of 5 and 10. Another idea shared was the use of base-ten blocks as a measurement tool to assist students in being precise with partitioning. It was observed, however, that students ran into a barrier distinguishing between a hundreds block and a tens block, as these manipulatives have equivalent widths. Their solution was to increase the height of a jump when representing a *jump of 100* as opposed to a *jump of 10*.

Back at my school, I was reviewing a formative assessment we had given our 4<sup>th</sup> graders before we started our unit on fractions. I was troubled by several of our students' inability to identify and partition fractions on a number line and decided to check in with my 3<sup>rd</sup>-grade teachers. The 3<sup>rd</sup>-grade team explained that they intentionally exposed students to different manipulatives related to fractions and that they used Cuisenaire rods to assist students with modeling fractions on a number line. They also shared that students had difficulty identifying and independently partitioning fractions on a number line. This led me to question how we are asked to approach the use of number lines in 2<sup>nd</sup> grade. I discovered that when teaching 2.MD.B.6, we introduce the open number line too soon to our 2<sup>nd</sup> graders without explicit instruction on important principles of the number line such as *order* and *intervals*.

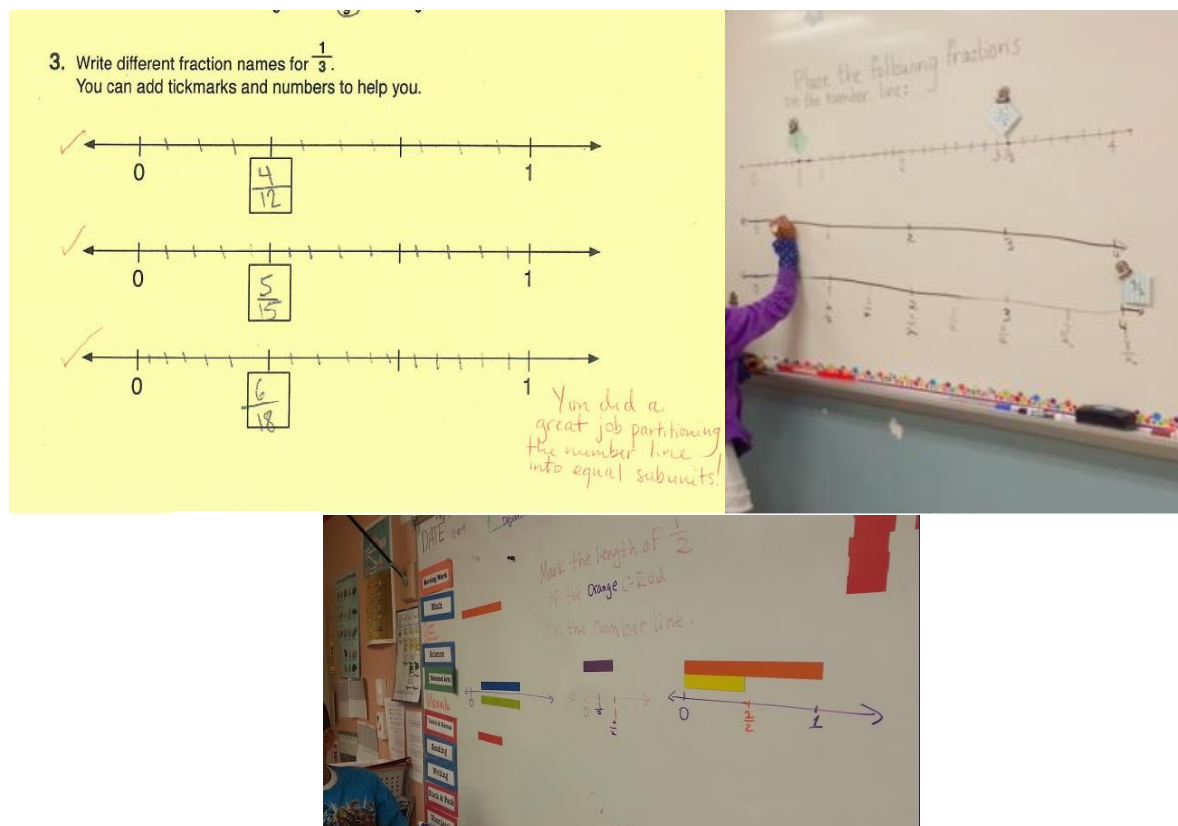
In thinking about the importance of the number line as a tool for computing with whole numbers in 2<sup>nd</sup> grade (2.MD.B.6) and teaching fractions on a number line in 3<sup>rd</sup> grade (3.NF.2) that leads to recognizing and generating equivalent fractions in 4<sup>th</sup> grade, I wondered if a resource existed that could assist my 2<sup>nd</sup> through 4<sup>th</sup> grade teachers with this instructional gap.

In my search, I stumbled into LMR (*Learning Mathematics through Representations*). Developed at the University of California, Berkeley, the LMR curriculum focuses on the representation of number on the number line. The curriculum is comprised of a series of lessons on positive integers, negative integers, and fractions. It uses a five-phase lesson structure: opening problems, opening discussion, partner work, closing discussion, and closing problem. The lessons include both routine and non-routine tasks. I co-taught all fourteen of the fraction lessons with my 4<sup>th</sup>-grade teacher, finding the explicit instruction of number-line principles and definitions to be valuable. Cuisenaire rods were used in the beginning lessons, and then there was a gradual release for students to independently partition number lines to generate equivalent fractions, and to order and compare fractions.

I also co-taught the positive integers unit with my new 2<sup>nd</sup>-grade teacher. What I appreciated most about the LMR lessons was the discovery approach to finding relationships between the Cuisenaire rods as *measurement tools to place and locate numbers on number lines* (LMR, 2013). The LMR curriculum also includes discussion questions that anticipate student misconceptions. I found this particularly helpful for my new teachers as we planned, but I believe that this would also benefit veteran teachers in examining student misconceptions about whole numbers and fractions on a number line.

At the end of the positive integers unit with 2<sup>nd</sup> graders and the fractions unit with 4<sup>th</sup> graders, I found that students demonstrated better facility with finding relationships between Cuisenaire rods and using the rods as measurement tools on a number line. Our 2<sup>nd</sup> graders demonstrated better reasoning with the placement of whole numbers on the number line after understanding the order principle and that numbers increase in size as we move from left to right on the number line. This, in turn, enhanced their abilities to compare and compute with whole numbers. Both our 2<sup>nd</sup> and 4<sup>th</sup> graders were more precise with their placements and identifications of whole numbers and fractions on a number line. Our 4<sup>th</sup>-graders also communicated their understanding of equivalent fractions by using vocabulary, such as *subunit* and *unit intervals*, to justify their thinking.

This year, I have asked all of our 2<sup>nd</sup>-, 3<sup>rd</sup>-, and 4<sup>th</sup>-grade teachers to use the LMR curriculum when teaching standards related to whole numbers and fractions on a number line. I believe that our intentional focus on the number line as an important representation and our explicit instruction of number-line principles in 2<sup>nd</sup> grade with whole numbers will strengthen our students' ability to apply number-line principles with respect to fractions, and enable them to identify, locate, and partition a number line with greater precision.



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