What is
Clothesline Math?
by Patricia Helmuth and Erica Kopp

Students often enter our adult education programs without a clear understanding of the relationship between fractions, decimals, percents, and negative and positive integers. While some students may recognize that 50% is the same as 1/2, many do not fully grasp the pedagogy behind determining basic equivalencies. To bridge this gap, many adult educators tap into adults' familiarity with money to help explain these concepts. For example, a classroom discussion might highlight how 25 cents is equivalent to 0.25, 1/4, and 25%. This often leads to an Aha! moment for students who have never connected these ideas despite their everyday experiences as consumers. However, more comprehensive instruction is needed for our adult students to thoroughly understand the relationships between all rational numbers.

Research suggests that using a number line during math instruction can help students develop number sense through relational thinking. When students see that each value has a specific place on a number line, it aids in building a conceptual understanding of the order and magnitude of numbers (Woods, 2017). For example, they can observe that 0.25, 1/4, and 25% all occupy the same position on the number line. This kind of understanding may not emerge if fractions, decimals, and percentages are taught separately, as is often the case in many math textbooks.

> The number line is well suited to support informal thinking strategies of students because of its inherent linearity (Frykholm, 2010).

Clothesline Math is an interactive number line that is a fun and hands-on way to learn math. It uses a real clothesline as a number line, where students can place cards with numbers, fractions, decimals, or even algebraic expressions. This method helps students see the relationships between different numbers and concepts more clearly. Just about any number line activity that you have used in the past can be carried over to a clothesline format. For teachers new to using number lines with students, this article will present a few ideas for immediate use in the classroom. The only needed supplies are a piece of clothesline, some clothespins, and some regular paper or cardstock.

At ANN's website you will find free printable clothesline math cards.

Closed Number Lines

A closed number line is a visual representation of a segment of the real number line, defined by specific endpoints. It is "closed" because it includes both endpoint values, often marked with a zero on the far left side of the number line and another value on the far right side. A closed number line helps illustrate the positions of numbers between the endpoints, which allows students to understand the order and magnitude of different values. For example, a closed number line might start at 0 and end at 1, including all the numbers in between, such as 0.25, 1/2, and 50%. This type of number line is useful for teaching concepts like fractions, decimals, and percents, as it visually demonstrates relationships within a defined range.

See the Math Fair How-to Guide at CollectEdNY.

Pictured above is an example of a number line activity used at the Sullivan County BOCES Math Fair (New York) in 2014. A clothesline had originally been planned for this event but since there was already a volleyball net in the gym, we used that instead. This closed number line included endpoints of -3 and +3 with the following intervals indicated : -3, -2, -1, 0, 1, 2, 3. All students who participated in the math fair event were given a card with a value on it as they entered the gym and were prompted to place the card on the makeshift number line in a place that made sense to them.

Keep in mind that a number line activity can be challenging for students that have not had any past experience in relational thinking, and they may even have developed misconceptions about the order and magnitude of numbers that need to be unraveled. For example, they might incorrectly believe that a larger denominator in a fraction means a larger value. These misconceptions can interfere with correctly placing values on a number line. This underscores how valuable number line instruction can be! With additional practice that extends beyond a one-time activity at a math fair, students will learn by watching other students place cards on the number lines, they will learn from their own mistakes, and they will learn through rich classroom discussion. Most importantly, students are afforded the opportunity to take positive steps in the direction of developing number sense.

For these reasons, incorporating a clothesline in the classroom for daily activities is highly recommended to enrich student learning. Spending just a few minutes each day asking students to place a card on the clothesline (or a paper number line) can significantly deepen their understanding of mathematical concepts while enhancing skills across all math domains.

Open Number Lines

An open number line does not have a fixed start or end point, allowing students the flexibility to assign their own values to its endpoints. There can be multiple correct ways to set up an open number line, as long as it accurately represents equivalent values at the same position, and the spacing between values is logical. As students work with an open number line, they may need to adjust the placement of values throughout the activity. Below is an example of an open number line where students have assigned endpoints to the number line.
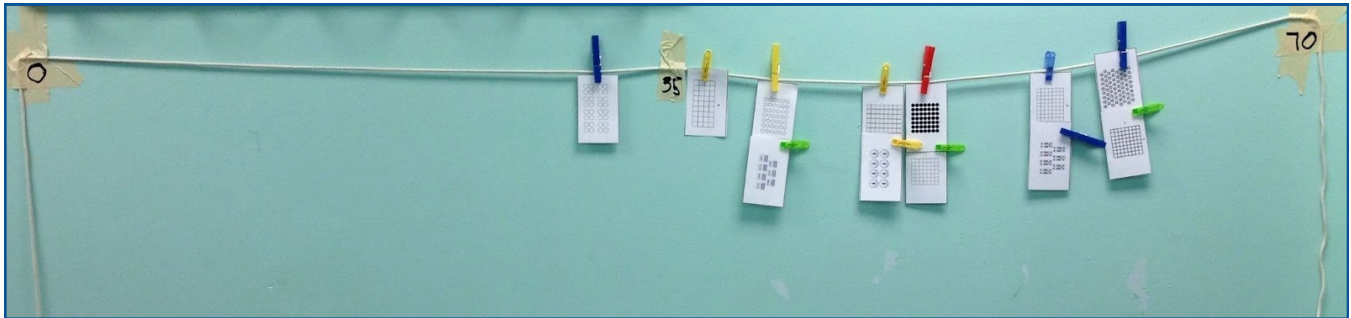

The students initially assigned zero as one endpoint, but as they began placing values on the number line they decided to put the value of 35 in the middle of the number line when they recognized the number line was heavily leaning towards one side. Eventually, as they moved through the activity, they settled on 70 as the endpoint for the right side of the number line.

However, another group of students working on this same activity assigned 30 as their endpoint on the left side of the number line as pictured below. While these two groups of students chose slightly different endpoints, the ordering and spacing each group placed on the number line demonstrated the same understanding. This clearly underscores the flexibility and openness that an open number line provides students. Without the constraints of specified endpoints, students can make decisions which demonstrate their comprehension of relationships between values. Students can also take ownership in their creation as opposed to placing values on a predetermined number line.
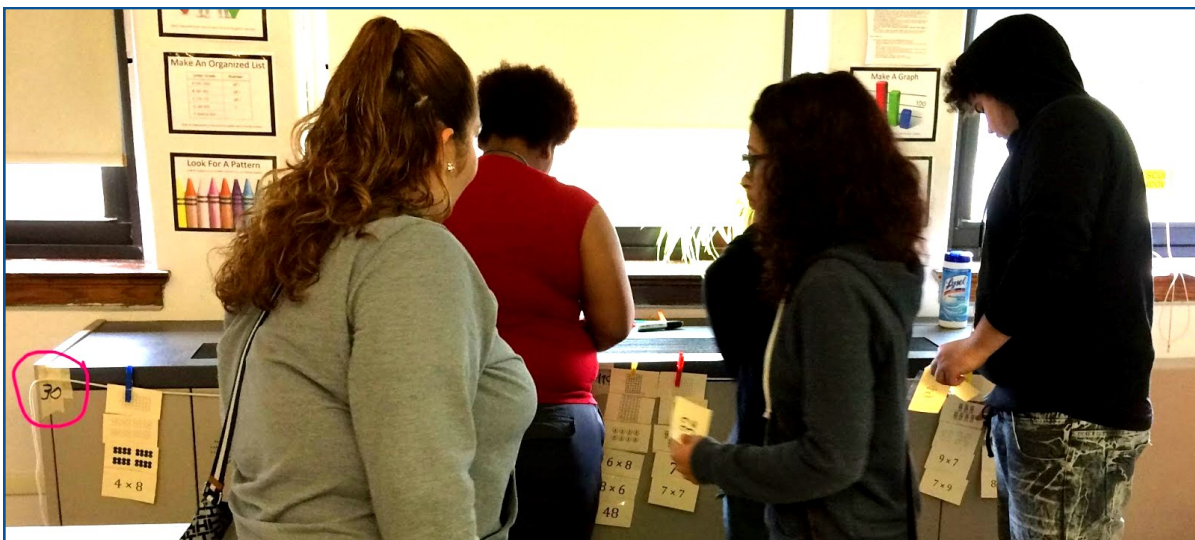
Clothesline Math offers a range of possibilities for deeper learning. For example, the [Math Cards](#) activity from YouCubed (2014), pictured below, challenges students to position different representations of the same value on a number line to demonstrate their understanding of how multiplication facts relate to various visual models. By engaging in this hands-on task, students build a conceptual understanding which surpasses memorizing multiplication tables. Students also benefit from a more meaningful connection to mathematical reasoning.
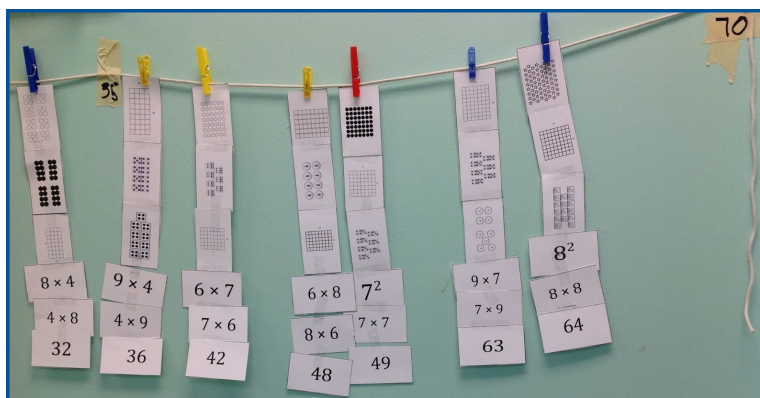
As students engage with the activity, they must reason about the magnitude of each visual model or multiplication fact and how it relates to others. For instance, although 9×4 (36) appears on the number line before 7×7 (49), some students might initially think that 7×7 should come first because 7 is less than 9. This misconception arises from focusing on each isolated number rather than reasoning through its values. However, as students begin to understand the value of a multiplication fact and connect it to a visual representation, their comprehension deepens.
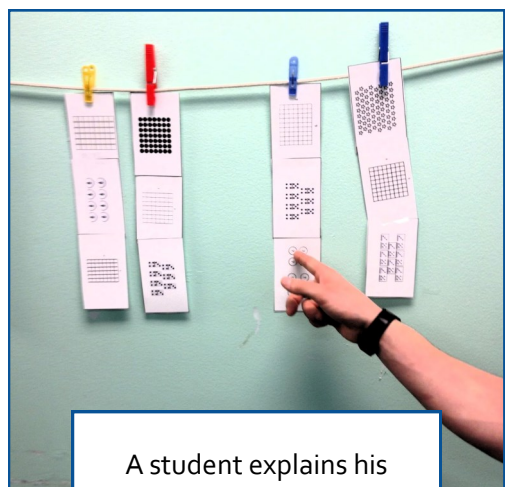
A student explains his reasoning.

This activity is enjoyable for students and offers significant learning opportunities. For example, students benefit by working together to place values on the number line as they discuss and defend their placements. This is in stark contrast to multiplication drills that are often timed while students work in silence and isolation with a worksheet as they try to fill in the facts they can remember as quickly as possible. Timed drills can create anxiety, which may hinder a student's ability to think clearly. When math facts can be discussed in a low-pressure environment, students can focus on understanding rather than speed. This can lead to a more positive attitude towards math.

Understanding the "why" behind math facts, as opposed to drills and memorization, leads to better long-term retention. Students are more likely to remember and use math facts correctly when they have a solid grasp of the underlying concepts. After participating in this activity, one student who had previously struggled with memorizing multiplication facts remarked, "I will now always remember that 6×7 is the same as 42."

Many students enter math programs with gaps in their foundational knowledge, especially when it comes to understanding the connections between fractions, decimals, percents, and negative and positive integers. Recognizing potential student learning gaps upon enrollment in adult education programs allows educators to tailor their instruction more effectively to meet learners where they are, and to guide them toward a deeper understanding of these fundamental mathematical ideas. Clothesline Math is a highly effective and versatile tool that can bridge learning gaps and enable students to *see* linear relationships that may have been shrouded by years of trying to memorize disconnected facts.

By having students physically move and arrange cards on an interactive number line, math lessons become more engaging. Students take control of their own learning as they work together to place values on a number line and defend their positioning. While this article highlights only two ways to use clothesline math in the classroom, nearly any number line activity can be adapted to this dynamic method. Embracing clothesline math can transform the way students perceive and engage with mathematics and can turn abstract ideas into tangible learning experiences that will stick with them long after they leave the adult education classroom.

References:

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Guess My Rule (created by Eric Appleton & Sarah Lonberg-Lew)

Explore 6 levels

designed to make learning functions exciting!

GAME CORNER

Guess My Rule!

Play Level 1
Play Level 2
Play Level 3
Play Level 4
Play Level 5
Play Level 6

Level 1 - Find the Rule

| | Go! |

In	Out
8	-2
6	-4

I think I know the rule!

Open Number Line

Directions: Place the numbers below on the number line.

2/2   1/2   3/4   1.5   0.75   5/4   0.25

$$\longleftarrow \rule{10cm}{0.4pt} \longrightarrow$$