# Counting Is the Foundation for Pre-K Mathematics Work

> " **Young children enter school with many ideas about number and these ideas should be built upon using a variety of experience to develop new relationships and advance mathematics understandings.** "
>
> –Van de Walle, 2019

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Students arrive in our classrooms with a variety of formal and informal mathematics experiences. A fundamental belief that should be held by all Pre-K educators is that each and every child that enters the classroom has important mathematical ideas. It is our job as educators to build upon those ideas and experiences to further each child on their mathematical journey. This certainly holds true for the foundational Pre-K concept of counting.

Students arrive in Pre-Kindergarten classrooms with a variety of understandings about how to count. Some arrive and may know many number names, the agreed upon order of those numbers, and how to tag objects when counting. Others may arrive knowing only a few number names and be less clear on how and what to count. It is likely that most students have had authentic experiences with counting where they have to decide things such as: "Who has more?"; "How many do I need?"; "Will there be enough?"; and more. So what are the important counting ideas that should be explored in a Pre-K classroom? The following are three critical components of learning to count: 1. The stable order principle (Gelman & Gallistel, 1978); 2. the one-to-one principle (Gelman & Gallistel, 1978); and the cardinal principle (Gelman & Gallistel, 1978).

## THE STABLE ORDER PRINCIPLE

As young children learn to count, they can be heard saying numbers in a repeatable order. Often, the order they repeat is not the standard order agreed upon. Children might be overheard singing or saying something like, "One, two, three, five, nine. . . ." What is interesting about many of these cases is that those children will repeat that same order time and time again. This is a clue that they are beginning to understand that number names are said in a certain order and that order is stable. This is a first step in understanding the standard order principle.

The stable order principle states that when counting, the words used to correspond to objects should be said is a stable and repeatable order. (Gelman & Gallistel, 1978) This principle contains two main components: when we count there is an agreed upon order in which we say the numbers and the conceptual idea that the order matters. When children learn to say the number names in the order agreed upon through song or verbal counting, they are taking the first step in this principle. Once they learn that order is important and doesn't change, they've fully realized this idea.

## THE ONE-TO-ONE PRINCIPLE

As children continue down their counting path, they begin to understand that when counting a set of objects, you can count the quantity by "tagging" objects with a number name. Like stable order, this process can sometimes be tricky. Children may touch objects with their fingers or hands as they say the number names out loud, but there may not be a formal connection as to how or why this is helpful and necessary. As children begin this work, they are beginning to engage with the one-to-one principle.

The one-to-one principle states that, when counting a set of objects, each and every object in the set is tagged with one and only one number in the counting sequence, and each number with one and only one object. (Schoen & Champagne, 2016)

## THE CARDINAL PRINCIPLE

Pre-K students may also begin to explore ideas around how to determine the total number of objects in a set. They may be overheard counting sets of objects within 10 and verbally emphasizing the last number name in the count. Children may count a set like this: "One, two, three, four, fiiiivvveee," where the last number is stretched out and often said louder. If young children do this, it may signal the beginning of their understanding of the cardinal principle.

The cardinal principle states that, when counting (in accordance with the stable order and one-to-one principles), the last number spoken has a special significance. This number describes a characteristic of the whole set. The last number word indicates the cardinality of the set. (Schoen & Champagne, 2016) Children begin to understand that the last number name they say when they count a set is the most important because it tell the quantity of that set. Rather than overemphasizing the last number name, one way to better communicate this to students is to count a set like this: "One, two, three, four, five, six. There are six turtles."



The work involved with this principle can be very challenging for young learners, and teachers should be aware of the language they use to assess a child's understanding. For example, when we ask, "Can you count these objects?" and they respond by correctly counting the objects in accordance with the stable order and one-to-one principle, we cannot be certain they understand the cardinal principle. It is not until we ask, "How many objects are there?" that we will truly know if children understand cardinality. It is good practice any time you observe a child count a set to follow up by asking, "How many objects are there?" You may find that they will recount the set when prompted by that question. These children are still beginning to understand the cardinal principle, but do not yet have a complete understanding.

How do we engage children in Pre-K with these first three counting principles? Here are three activities that provide students with the opportunity to engage with these three counting principles.

**Count and Move** Have children repeat a motion (touch their toes, jump, clap, or stomp their feet) and count the motion out loud. This can be modeled by an adult or done in unison with the class. This activity helps children understand both stable order and one-to-one principle. (Clements & Sarama, 2016)

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**Quick Images** Quickly show children an arrangement of dots and have students respond verbally with the number.



This activity helps with a related idea called subitizing where students can quickly recognize the numerosity of a group of objects. This idea is foundational in helping children understand the cardinal principle and moving to more complex counting ideas. (Russel et al. *Quilt Squares and Block Towns: Investigations in Number, Data, and Space®* 18-19, 193, 210)

**Mr. Mix Up** Introduce children to a puppet called Mr. Mix Up who makes mistakes when he counts. The children's job is to look for the mistake. Mr. Mix Up can make mistakes with any of the three principles described above. For example, he can tag two different objects with the same number name or skip over some objects when counting a set. He can also help with the cardinal principle by making the following mistake: "One, two, three, four, five, six, seven. There are five objects in this set."

These three principles are at the core of a sound mathematics program in Pre-Kindergarten. They lay the foundation for children to be successful in future mathematics journeys.

## REFERENCES

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