



Teaching Math Classically

with Andrew Elizalde

Lesson 4: The Grammar of Mathematics

Outline:

The Grammar of Mathematics

- *Where does the most basic understanding of mathematics begin?*
- *How do we take into account these intuitions and bring children to computational proficiency?*

From the previous lesson

- While the cognitive stage was not the historical understanding, it does prove to be helpful, but the imperative is that we understand the way the adolescent mind develops, remembers and understands
- Our concepts of the grammar of mathematics, namely the operations of addition, subtraction, division and multiplication have been an overly rigid simplification of the trivium.

Where does the most basic understanding of mathematics begin, and does the current system account for it?

- There is evidence that prior to the learning of the basic operations (Addition, subtraction, multiplication and division), children already possess some intuitive understanding of mathematics and calculations.
 - This intuition can be seen before the child even reaches kindergarten!
- These earliest mechanisms grasped include counting, place value, relationships between shapes, quantities, areas and objects, and characteristics of these objects
 - “Counting is the Swiss army knife of arithmetic, the tool that children spontaneously put to all sorts of uses. With the help of counting, most children find ways of adding and subtracting numbers without requiring any explicit teaching beforehand” – Stanislas Dehaene, *The Number Sense*
- Schools pushing rote learning of computational proficiency at an early age does not account for these intuitions, demanding students to simply store a wealth of numerical knowledge in memory.
 - While most students get through, they lose their intuitions of arithmetic in the process
- Perhaps the current system pushes computational proficiency much too soon



- Computational proficiency is important, but we should not rush into it at the expense of child's intuition.

Moving away from rote learning, how do we bring children to early computational proficiency?

- Through experiences that play into their mathematical intuitions and resonate with their already present concepts of quantity and space.
- Students at early ages learn these concepts best through visual, physical and concrete experiences.
- We can make abstract concepts concrete through the use of manipulatives in the classroom.
 - The place value system
 - Strategies for counting
 - Preservation of quantity in space
- Using visual aids to help students gain an understanding of breaking things apart and putting them together, and learning to multiply
 - The number bonds
 - Skip-counting and eventually simply multiplication
- Taking the time to make sure the students visualize and understand the concepts taught is building and reinforcing a foundation in mathematics, which will ultimately result in memorization and understanding of later, more abstract concepts.