



Teaching Math Classically with Andrew Elizalde

Lesson 3: The Trivium and Mathematics Education

Outline:

The Trivium and Mathematics Education

- *How was our current understanding of the trivium – particularly grammar – in mathematics formed? How does this inform the way we teach mathematics?*
- *Is this consistent with the historical interpretation, and if not, is it still relevant?*
- *Do we require a new understanding of the idea of the trivium as it relates to mathematics?*

Current Popular Interpretations of the Trivium

- To associate grammar, logic and rhetoric as three stages of cognitive development in a child
- These three parts represent actual content and courses to be studied (I.e.: logic and rhetoric classes)
- Grammar, logic and rhetoric can provide us a lens on which to assess and implement our pedagogy (such as certain elements in our teaching)
- **The Cognitive Stage interpretation**
 - The association of the trivium with cognitive stages is a relatively modern invention, popularized by Dorothy Sayers in her essay *The Lost Tools of Learning*
 - Sayers describes the trivium in relation to three stages in her childhood.
 - The “Poll parrot”/ The grammar stage: Learning by heart is easy and pleasurable, with reasoning being difficult. Children at this stage delight in accumulating information and memorizing things
 - The “Pert”/The logic stage: Children at this stage begin contradicting, answering back, and seeking to understand why things are so.
 - The “Poetic”/the rhetoric stage: This usually follows puberty, where teenagers yearn to learn to express themselves, achieve independence, and begin to understand synthesis and specialization.
 - While largely accepted, this isn’t necessarily the originally understood interpretation of the trivium
- **The Historical Interpretations of the Trivium**



- In ancient history, the parts of the trivium were emphasized and deemphasized according to personal philosophies
 - In ancient schools, the order was grammar, rhetoric, then dialectic
 - Varro on the other hand taught grammar, dialectic then rhetoric
 - Boethius and his followers also treat rhetoric third, reflecting a philosophical view that knowledge is first discovered dialectically and expressed rhetorically
- The trivium then, was not as much informed by cognitive stages as much as the philosophy of education

Can a Synthesis be Formed?

- While the modern interpretation of the trivium may not have been its original interpretation, it still contains many insights for teaching – there is still much evidence for the progression of thought and reasoning in cognitive and biological psychology, and it remains imperative that we understand adolescent cognition to effectively understand what they need.
 - Recent advances in neurobiology and cognitive psychology resonate with understandings inherited from ancient times – such as the arts of memory in classical Christian education.
 - An understanding of how to teach the trivium, grammar in particular, will benefit from an understanding of how the mind develops and changes throughout childhood and adolescence.
 - A synthesis can be formed then, with modern cognitive psychology and its understanding of plasticity with the ancient understanding of memory and the trivium
 - Neuroplasticity, as defined by Joshua Foer: [The brain] is composed of somewhere in the neighborhood of 100 billion neurons, each of which can make upwards of five to ten thousand synaptic connections with other neurons. A memory, at the most fundamental physiological level, is a pattern of connections between those neurons. Every sensation that we remember, every thought that we think, transforms our brains by altering the connections within that vast network. By the time you get to the end of this sentence, your brain will have physically changed!
 - We are created to adapt, to shape ourselves through these our habits, and because of this ability, we should be able to form an effective interpretation of the trivium as it relates to cognitive development.

Is there a new understanding that we need to have about the idea of grammar in mathematics?

- Is there something more than just knowing your arithmetic facts? Have we had too narrow view of math and oversimplified interpretation of the earliest forms of mathematical understanding looks like?



- **The current understanding**
 - “The grammar of Mathematics begins, of course, with the multiplication table, which, if not learnt now, will never be learnt with pleasure; and with the recognition of geometrical shapes and the grouping of numbers. These exercises lead naturally to the doing of simple sums in arithmetic. More complicated mathematical processes may, and perhaps should, be postponed, for the reasons which will appear later” – Dorothy Sayers, *The Lost Tools of Learning*
 - Arithmetical proficiency is the grammar of mathematics
 - This attitude from the 90s became the foundation of current U.S core curriculums, the only differences being the attitudes of the teacher
 - Anything that can be committed to memory should be memorized at this period, gathering the material to use in the next part of the trivium – logic.
 - More advanced mathematics appear later as a subdivision of logic, and so the accumulated facts in the grammar period can be connected later.
- **A new understanding**
 - What we’ve come to realize is that we might have limited grammar too much to computational proficiency, having had a too narrow view of mathematics and thus an oversimplified interpretation of the earliest forms of mathematical understanding.
 - In Sayer’s times, mathematics was understood to be a logical stage, a logical exercise, and the role of the grammar stage was simply to accumulate a mound of facts to be used later
 - Mathematics cannot simply be reduced to an exercise in logic!
 - Kurt Godel with his incompleteness theory proved that the project of reducing mathematics into a simple, self-consistent logical exercise is impossible.
 - If mathematics is not purely something to be grasped in the logical stage, our current understanding of the grammar of mathematics is then inherently flawed.
 - Therefore, we must refine our understanding of the grammar of mathematics.