

7.11 Mathematics Policy

Principles for Teaching Elementary Mathematics:

1. The United States has historically taught mathematics procedurally. With the *procedural* approach students are taught “cookbook steps” for solving problems. Studies show that students are able to extract simple concepts from procedural teaching in the early grades, but in later years, as concepts become more difficult, understanding is lost, and students retain less knowledge.
2. Liberty utilizes a *conceptual* approach to teaching mathematics. With the conceptual approach, it is not enough to assert something is true, instead teachers (and students) must be able to prove why something is true every step of the way, based on concepts the students already know and understand. Once students understand why something works, they can apply the concept to other situations.
3. New knowledge builds on old knowledge. To be successful, students need to thoroughly master a math concept before moving on to the next.
4. As students progress along the Thinking Framework, students should recognize multiple ways of solving a problem, be able to evaluate each approach, and determine which would be the most reasonable to use.

The Singapore National Math Curriculum is a conceptual math curriculum which supports these principles and been approved for math instruction in kindergarten through 7th grade (Pre-Algebra) at Liberty Common School.

Principles for Teaching Upper School Mathematics:

1. Many junior high schools in the United States employ an integrated approach to math that attempts to spread the material from Algebra 1, Geometry, and Algebra 2 over the course of three years. The math material is sometimes diluted with social studies and science to solve “real world” problems. This curriculum is inconsistent with conceptual mathematics because in many cases the math concepts are presented in a fragmented way so that mastery is not developed and thus student understanding is reduced.
2. A fundamentally sound understanding of Algebra is critical to further studies in math and science.
3. The study of Geometry/Trigonometry develops logic and thinking skills necessary for higher level mathematics, science, mature writing composition, philosophy, and general research.
4. Through an in-depth study of Algebra and Geometry students become very familiar with multiple approaches to solving the same problem and develop the

thought process (reasoning) involved in identifying the “best” option for a given problem.

The 2006 3rd edition Foerster Algebra 1 textbook and the Weeks-Adkins, Geometry, Algebra 2 series support these principles and have been approved for upper school mathematics courses at Liberty Common School.

Skill Development:

- Skills and understanding are heavily intertwined. Teachers must combine the approved math curriculum with proper emphasis on automation of skills
- Automaticity, the ability for students to immediately recognize math facts, takes practice. Automaticity allows students to focus their mental energies on the demands of more difficult math concepts. Teachers will establish expectations for math fact automaticity at each grade level.
- Fluency in executing basic math skills is essential for students to progress to the next level. Once concepts are taught, students should be assigned sufficient practice problems so that students develop fluency of the math operations.

Calculators:

- Calculators prevent automaticity and are not to be used for math in grades K-6.
- Calculators may be used in upper school math, science, and economics courses only after students have developed automaticity and mastery of the math concepts being used.
- Upper school teachers may develop additional policies and procedures for the use of calculators, as appropriate.

Curriculum Considerations:

- The approved curricula (Singapore Math and Weeks-Atkins) may not cover all math content in the Core Knowledge Sequence. In accordance with the school’s Educational Priorities policy, teachers should follow the timeline in the approved math curriculum rather than the Core Knowledge Sequence. Teachers should verify, however, that the Core Knowledge math content for their grade level is covered at some grade level in the approved curriculum. Any gaps in the approved curriculum should be documented and provided to the Headmaster.
- Teachers must review Colorado state standards and ensure students have covered the required standards.

Supporting References:

- *Knowing and Teaching Elementary Math* by Liping Ma

- *Basic Skills Versus Conceptual Understanding*, by H. Wu, American Educator, Fall 1999
- *A Review of an Integrated High School Mathematics Program* by Diane Fogler, mathematicallycorrect.com

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