The 2017 Mathematics Curriculum Framework draws from the best of prior Massachusetts standards, and represent the input of hundreds of the Commonwealth’s K–12 and higher education faculty. The framework reflects the Commonwealth’s commitment to providing all students with a world-class education. This version of the Framework retains the strengths of previous frameworks and includes three key shifts: *Clarity*, *Coherence*, and *Rigor*. **This guide focuses on *Rigor* and is designed to support districts to implement mathematically rigorous instruction in grades Pre-K – 5, as described in the** [***2017 Mathematics Curriculum Framework***](http://www.doe.mass.edu/frameworks/math/2017-06.pdf)**.**

The Massachusetts Curriculum Frameworks provide teachers, students and families with clear and shared expectations for what all students should know and be able to do at the end of each year. They represent a promise of equitable education for all students. They formalize the expectation that all students in the Commonwealth have access to the same academic content, regardless of their zip code, background, or abilities.

**Mathematical Rigor – A Balanced Approach**

The 2017 Mathematics Curriculum Framework defines mathematical rigor as a balance of Conceptual Understanding, Procedural Fluency, and Application (Capacity). The relationship between the three elements is represented by a triangle, figure 1. Each element is dependent on the other, however no element is primary. For example, procedural fluency is not a perquisite for the capacity to apply math to solve real-world problems. Balanced instruction develops student understanding of mathematical concepts alongside, and with equal emphasis on, mastering procedural skills and solving real world problems.

Figure 1

* **Conceptual understanding** – make sense of the math, reason about and understand math concepts and ideas
* **Procedural fluency** – know mathematical facts, compute and do the math
* **Capacity** – solve a wide range of problems in various contexts by reasoning, thinking, and **applying** mathematics

#### Key Shifts – Examples from the 2017 Framework

***Clarity***

* Revised definitions of the Standards for Mathematical Practice for grade bands (Pre-K – 5, 6 – 8, HS)
* Clarified expectations for student mastery and fluency of basic facts and algorithms

 ***Coherence***

* The progressions of Pre-K – 5 standards in *Number and Operations in Base Ten* and *Fractions* prepare students for learning the standards within the *Ratios and Proportional Relationships* and *The* *Number System* domains in grades 6 – 8.

**Mathematical Rigor – A Balanced Approach**

The 2017 Mathematics Curriculum Framework definition of mathematical rigor supports the work of educators in multiple ways. For example, educators can use Mathematical Rigor as a construct to unpack individual grade-level standards. By using the *Standard Analysis Protocol* educators learn that many standards are embedded with complementary conceptual understanding, procedural fluency, and application (capacity) expectations. This is vital information to consider when designing instruction and assessments. In addition, analysis based on rigor can extend to instructional tasks and lessons. With a comprehensive understanding of standards, educators should be critical of the curricular materials they use with students. [Research shows](http://www.doe.mass.edu/instruction/curate/why.html) that by using high-quality, standards aligned curricular materials can prompt improvements in student performance. By using the *Task/Lesson Analysis Protocol* educators learn how to unpack a given lesson or task to determine how and if sufficient instructional time and strategies are included to meet objectives targeting all aspect of rigor. Lessons and tasks may prioritize one aspect of rigor without making intentional connections to the other two. Ultimately, instruction, lesson and unit planning, and assessments should be designed to achieve a balance of conceptual understanding, procedural fluency, and application.

**Mathematical Rigor – Analysis Tools**

| Standard Analysis Protocol |
| --- |
| Objective:For participants to be able to *analyze content standards using the three aspects of Mathematical Rigor.*  |
| Purpose:This protocol guides participants through a process of analyzing standards to better understand how the three aspects of Mathematical Rigor are embedded in many standards. Participants go through two examples together and then create rigor based objectives for a 1st grade standard. This protocol can be used with any grade level content standard to analyze curricular materials, instruction, and assessments.  | Resources:* [Presentation](http://www.doe.mass.edu/stem/math/rigor-k5-standard-slides.pptx)
* [Handout](http://www.doe.mass.edu/stem/math/rigor-k5-standard-handout.docx)
* [*Handout key*](http://www.doe.mass.edu/stem/math/rigor-k5-standard-key.docx)

Approx. Time Required: 2 ¼ *hrs* |

| Task/Lesson Analysis Protocol |
| --- |
| Objective:For participants to be able to *analyze mathematical tasks and lessons using the three aspects of Mathematical Rigor.*  |
| Purpose:This protocol guides participants through a process of analyzing math lessons and tasks to better understand how the three aspects of Mathematical Rigor can be targeted through instruction. Participants will analyze both written lessons and a video of classroom instruction. Using this protocol supports educators to adapt and prioritize lessons and tasks to better meet the needs of their students and balance instruction to address the three aspect of Mathematical Rigor | Resources:* [Presentation](http://www.doe.mass.edu/stem/math/rigor-k5-task-lesson-slides.pptx)
* [Handout](http://www.doe.mass.edu/stem/math/rigor-k5-task-lesson-handout.docx)

Approx. Time Required: 2 ½ *hrs* |

**Check It Out!**

CURATE – CUrriculum RAtings by TEachers - <http://www.doe.mass.edu/instruction/curate/>

MA Standard Navigator - <https://tinyurl.com/y5eed7v5>

OPTIC: Online Platform for Teaching and Informed Calibration - <http://www.ma-optic.com/>