K-8 Aspects of Rigor Guidance Document

Rigor refers to deep, authentic command of mathematical concepts, not making math harder or introducing topics at earlier grades. To help students meet the standards, educators need to pursue, with equal intensity, three aspects of rigor in the major work of each grade: conceptual understanding, procedural skills and fluency, and application.

Each Aspect of Rigor is listed below, with an explanation of what it is and guiding questions to help you understand what to look for in the materials. Two things to keep in mind:

(1) The three aspects of rigor are not always separate in materials. (Conceptual understanding and fluency go hand in hand; fluency can be practiced in the context of applications; and brief applications can build conceptual understanding.)

(2) Nor are the three aspects of rigor always together in materials. (Conceptual understanding must be and purposely taught rather than expecting student to infer conceptual understanding through the teaching of procedures.)

Aspect of Rigor	What it is:	Guidance:
Conceptual Understanding	Conceptual understanding: comprehension of mathematical concepts, operations and relations. Students with conceptual understanding know more than isolated facts and methods. Students see the connections among concepts and procedures and can give arguments to explain why some facts are consequences of others.	Are cluster(s) or standard(s) from the grade-level that specifically relate to conceptual understanding (look at it throughout the whole grade-level) developing conceptual understanding? Are math practices (look at it throughout the whole grade-level) developing conceptual understanding? Is conceptual understanding developed thoroughly where the standards set explicit expectations for understanding or interpreting? *For example, suppose students are adding fractional quantities of different sizes, say* $\frac{1}{3}$ + $\frac{2}{5}$. *They might draw a picture or use concrete materials of various kinds to show the addition. They might also represent the number sentence* $\frac{1}{3} + \frac{2}{5} = ?$ *as a story.* Do materials feature high-quality conceptual problems and conceptual discussion questions? Do program materials call for students to use concrete and/or visual representations, as well as verbalization, when developing conceptual understanding?

		Do the materials feature opportunities to identify correspondences across mathematical representations?
Procedural Skill and Fluency	Procedural fluency refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently. Students also need to know reasonably efficient and accurate ways to add, subtract, multiply, and divide multi-digit numbers, both mentally and with pencil and paper. Students need to see that procedures can be developed that will solve entire classes of problems, not just individual problems.	Is instructional time given for students to build conceptual understanding and proficiency in the mathematical practices and to develop fluency in standard computational algorithms that is based on their understanding of properties, operations, and the base-ten number system? Is there attention throughout the year to build fluency with procedures on a foundation of conceptual understanding? Is there progress toward fluency and procedural skill interwoven with students' developing conceptual understanding of the properties of operations? Are there opportunities for students to be able to perform such operations as finding the sum of 199 and 67 or the product of 4 and 26 by using quick mental strategies rather than relying on paper and pencil? Do materials in grades K-6 (within the grade-band reviewing) provide well-timed practice of the skills students are learning so that they are not handicapped in developing the other strands of proficiency? Do students have opportunities to practice on a moderate number of carefully selected problems after they have established a strong conceptual foundation and the ability to explain the mathematical basis for a strategy or procedure?
Applications of Mathematics	The standards call for students to use math in situations that require mathematical knowledge. Correctly applying mathematical knowledge depends on students having a solid conceptual understanding and procedural fluency. To engage in application: ● Students need opportunities to apply	Are there a variety of single- and multi-step contextual problems, including non-routine problems that develop the mathematics of the grade? Do the problems attend thoroughly to the content standards where expectations for multi-step and real-world problems are explicit? Does application build slowly across the grade band under review, with simpler

	mathematical knowledge and/or skills in a real-world context. ● Materials should promote activities that call for the use of mathematics flexibly in a variety of contexts in both routine and non-routine problems. ● Students are given opportunities to use math to make meaning of and access content.	applications in the early grades and when new content is introduced, to more complex applications in the middle grades that begin to provide opportunities for students to make their own assumptions or simplification in order to apply the mathematics in a given situation?

Resources:

K-8 Publishers' Criteria for the Common Core State Standards for Mathematics, corestandards.org

K-8 Math Evidence Guides Combined, edreports.org

http://www.corestandards.org/other-resources/key-shifts-in-mathematics/