Common Core State Standards for Student Mathematical Practices

April 16, 2011

RE: Explaining the Proficiency Matrix

Dear Mathematics Educator,

The Standards of Student Mathematical Practice, as delineated and explained in the Common Core State Standards (CCSS), are based upon previous research and reasoning from the National Council of Teachers of Mathematics (NCTM) in the *Principles and Standards for School Mathematics* (2000) and from the National Research Council (NRC) in the book, "*Adding It Up*" (2001). These identified CCSS student practices and supporting research provide the conditions under which students learn mathematics with deep conceptual understanding.

After reading and studying these practices, it is apparent to us that the practices are not skill-based content that students can learn through direct teaching methods, but rather ones that emerge over time from opportunities and experiences provided in mathematics classrooms. These opportunities and experiences coordinated by mathematics teachers must include challenging problems, student collaborative groups, interactive discourse, and adequate time.

Students' abilities develop as opportunities are provided. With teacher guidance, students' abilities expand from initial, to intermediate, to advanced. As a means to help students continue in a pattern of growth with mathematical proficiency, our matrix is offered as a way to consider and gauge students' progress for each of the practices. The matrix works in parallel to our companion document, "**An Instructional Implementation Sequence for Attaining the CCSS Student Practices in Mathematics**." The sequenced strategies are from Hull, Balka, and Harbin Miles (2011).

The numbers assigned to each of the eight practices in our matrix are for organizational purposes only. The numbers do not indicate a developmental sequence or priority. The practices are interdependent, and do not develop in isolation from one another (as observed in our companion form specified above). While it is possible, and probably desirable, to focus on a few practices within a lesson unit, mathematics educators need to continually assess student progress on these practices in a holistic fashion. Furthermore, in using the matrix, mathematics teachers and leaders need to apply their knowledge of grade appropriate content and pedagogy to adjust our indicators of progress.

Our desire is to provide a tool based upon the student practices identified in the CCSS that assists mathematics leaders and teachers in the improvement processes of planning, presenting, analyzing, and reflecting (Hull, Balka, and Harbin Miles, 2009). Through these processes, students' progress in achieving the Standards for Mathematical Practice can be assessed, and success in mathematical learning obtained.

While our matrix is copyrighted, LCM grants permission to mathematics leaders and teachers to use the matrix for personal improvement as well as professional development training providing that appropriate credit is given. We sincerely hope you find this tool helpful, and your students obtain mathematical proficiency along with a deep desire to continue their study of mathematics.

Sincerely,

LCM

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Standards of Student Practice in Mathematics Proficiency Matrix

	Students:	(I) = Initial	(IN) = Intermediate	(A) = Advanced
1a	**Make sense of problems**	Explain their thought processes in solving a problem one way. PS	Explain their thought processes in solving a problem and representing it in several ways. QW	Discuss, explain, and demonstrate solving a problem with multiple representations and in multiple ways. GE
1b	**Persevere in solving them**	Stay with a challenging problem for more than one attempt. QW	Try several approaches in finding a solution, and only seek hints if stuck. GE	Struggle with various attempts over time, and learn from previous solution attempts SS
2	**Reason abstractly and quantitatively**	Reason with models or pictorial representations to solve problems. GE	Are able to translate situations into symbols for solving problems. GE	Convert situations into symbols to appropriately solve problems as well as convert symbols into meaningful situations. ER
3a	**Construct viable arguments**	Explain their thinking for the solution they found. ST	Explain their own thinking and thinking of others with accurate vocabulary. QW	Justify and explain, with accurate language and vocabulary, why their solution is correct. GE
3b	**Critique the reasoning of others.**	Understand and discuss other ideas and approaches. PS	Explain other students' solutions and identify strengths and weaknesses of the solution. QW	Compare and contrast various solution strategies and explain the reasoning of others. GE
4	**Model with Mathematics**	Use models to represent and solve a problem, and translate the solution to mathematical symbols. GE	Use models and symbols to represent and solve a problem, and accurately explain the solution representation. QP	Use a variety of models, symbolic representations, and technology tools to demonstrate a solution to a problem. SS

5	**Use appropriate tools strategically**	Use the appropriate tool to find a solution. GE	Select from a variety of tools the ones that can be used to solve a problem, and explain their reasoning for the selection. GE	Combine various tools, including technology, explore and solve a problem as well as justify their tool selection and problem solution. SS
6	**Attend to precision**	Communicate their reasoning and solution to others. ST	Incorporate appropriate vocabulary and symbols in others. SS	Use appropriate symbols, vocabulary, and labeling to effectively communicate and exchange ideas. ER
7	**Look for and make use of structure**	Look for structure within mathematics to help them solve problems efficiently (such as 2 x 7 x 5 has the same value as 2 x 5 x 7, so instead of multiplying 14 x 5, which is (2 x 7) x 5, the student can mentally calculate 10 x 7. QP	Compose and decompose number situations and relationships through observed patterns in order to simplify solutions. SS	See complex and complicated mathematical expressions as component parts. ER
8	**Look for and express regularity in repeated reasoning**	Look for obvious patterns, and use if/ then reasoning strategies for obvious patterns. GE	Find and explain subtle patterns. SS	Discover deep, underlying relationships, i.e. uncover a model or equation that unifies the various aspects of a problem such as a discovery of an underlying function. ER