

Teacher Quality Standard I

Teachers demonstrate mastery of and pedagogical expertise in the content they teach. The elementary teacher is an expert in literacy and mathematics and is knowledgeable in all other content that he or she teaches (e.g., science, social studies, arts, physical education, or world languages). The secondary teacher has knowledge of literacy and mathematics and is an expert in his or her content endorsement area(s).

The key to distinguishing the knowledge base of teaching rests at the intersection of content and pedagogy.

—L. S. Shulman

To teach all students according to today's standards, teachers need to understand subject matter deeply and flexibly so they can help students create useful cognitive maps, relate one idea to another, and address misconceptions. Teachers need to see how ideas connect across fields and to everyday life. This kind of understanding provides a foundation for pedagogical content knowledge that enables teachers to make ideas accessible to others. (Shulman, 1987)

Although Shulman's work dates back to the late 1980s, the importance of teacher content knowledge and pedagogical expertise has never been more important than it is now as teachers ensure students are college and career ready for the demands of the 21st century.

Element C: Math Teachers

Teachers demonstrate knowledge of mathematics and understand how to promote student development in numbers and operations, algebra, geometry and measurement, and data analysis and probability.

This section describes professional practices that should be demonstrated by Teachers responsible for teaching math.

The great book of nature can be read only by those who know the language in which it was written. . . and that language is mathematics.

—Galileo

Professional practices appearing under each element of the Rubric for Evaluating Colorado Teachers are cumulative. Therefore, for teachers of math to be proficient in demonstrating knowledge of mathematics and how to promote student development of mathematical concepts and skills, they must provide instruction that is a balance of conceptual understanding and procedural skills and is sequenced and appropriate for the age and grade of their students. Teachers also establish an environment where



[Click here to go back to the table of contents and view the resource guide in its entirety.](#)

students are actively engaged in doing math that challenges their thinking, stimulates their curiosity, and encourages them to investigate further.

BASIC RATING LEVEL

PROFESSIONAL PRACTICES: THE TEACHER:

Focuses math instruction beyond:

- ***Recall of facts.***
- ***Development of computational skills.***
- ***Math as a series of rote procedures.***

The Colorado Academic Standards call for rigorous math instruction that moves beyond knowledge of math as a set of facts or procedures. For Colorado students to demonstrate mastery of the standards, they must develop:

- Fluency, application, and transfer of math skills.
- A conceptual understanding that includes the what, how, and why of math content and skills.

Getting the correct answers is essential in math, but that is only part of the learning students need to master math content. For students to think like mathematicians and be able to apply math to real-world problems, they must develop a conceptual understanding of math that goes beyond rote learning.

[The] speedy recollection of facts should not be confused with real mathematical skill. Good mathematical strategies—not quick memorization—are what really matter in understanding mathematics (Mokros, Russell, & Economopoulos, 1995, p. 72).

If fluency is the goal, classroom instruction must emphasize the development and application of strategies; rote memorization of isolated facts will not suffice to develop proficiency with basic facts (Kilpatrick, Swafford, & Findell, 2001).

Refer to these external resources for additional information:

- Article: “Beyond One Right Answer” by Marian Small
<http://www.ascd.org/publications/educational-leadership/sept10/vol68/num01/Beyond-One-Right-Answer.aspx>
Article describes how the teacher can differentiate questions to move students beyond just a recall of facts and finding the right answer.
- Article: “Fluency with Basic Addition” by Gina King
<http://www.slideshare.net/jwalts/math-fluency>
Article, presented as a slide show, explains the differences between basic recall of facts and fluency.
- Website: Tools for Sense-making in Mathematics sponsored by SERP



[Click here to go back to the table of contents and view the resource guide in its entirety.](#)

<http://math.serpmedia.org/sense-making/>

Website provides ways to move math instruction from a focus on answer-getting to sense-making.

Models:

- ***Appropriate mathematical communication.***

The teacher creates classroom structures and interactions that provide opportunities for students to articulate their mathematical thinking. “The role of the teacher is to engage students in tasks that promote reasoning and problem solving and facilitate discourse that moves students toward shared understanding of the mathematics.” (“Principles to Actions”, 2014)

Communication is an essential part of mathematics and mathematics education. It is a way of sharing ideas and clarifying understanding. Through communication, ideas become objects of reflection, refinement, discussion, and amendment. The communication process also helps build meaning and permanence for ideas and makes them public. (“Principles and Standards for School Mathematics”, 2000)

The National Council for Teachers of Mathematics Instruction emphasizes the importance of mathematical communication by posting the following on its website:

Programs from prekindergarten through grade 12 should enable all students to:

- Organize and consolidate their mathematical thinking through communication.
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.
- Analyze and evaluate the mathematical thinking and strategies of others.
- Use the language of mathematics to express mathematical ideas precisely.

- ***A variety of mathematical practices.***

The Colorado Academic Standards and Common Core State Standards for Mathematics include the following mathematical practices:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model real-world phenomena using mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

For students to master these practices and understand their connections to math content, “the effective teacher provides students with appropriate challenge, encourages perseverance in solving problems, and supports productive struggle in learning mathematics.” (Principles to Actions, 2014)



[Click here to go back to the table of contents and view the resource guide in its entirety.](#)

Refer to these external resources for additional information:

- The Standards for Mathematical Practice, annotated for the K–5 classroom
<http://commoncoretools.me/wp-content/uploads/2014/02/Elaborations.pdf>
Document provides explanations of the Standards for Mathematical Practice that are appropriate for grades K–5.
- Principles to Actions: Ensuring Mathematical Success for All
<http://www.nctm.org/principlestoactions/>
Book and e-book published by NCTM in 2014. Provides research-based practices and examples.
- Website: <http://omsd.omsd.k12.ca.us/departments/lss/academics/commoncore/Documents/SMP-Posters/Posters-K-1.pdf>
Website provides visuals appropriate for teaching the Standards for Mathematical Practice to early childhood and elementary students.

- Website: Standards for Mathematical Practice maintained by Biting into the Core
<http://www.bitingintothecore.com/standards-for-mathematical-practice.html>
Website provides resources for modeling and engaging students in the Standards for Mathematical Practices at all grade levels. Videos are included.

Refer to this internal resource for additional information:

- Standards for Mathematical Practice
Document provides explanations for each mathematical practice as part of the Colorado Academic Standards.



[Click here to go back to the table of contents and view the resource guide in its entirety.](#)