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: All 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 ALL TEACHERS, regardless of grade level or subject.

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 referenced under each element of the Rubric for Evaluating Colorado Teachers are cumulative. Therefore, for teachers to be proficient in demonstrating knowledge of mathematics and how to promote student development of mathematical concepts and skills, they must encourage students to make explicit math connections to the content being taught. These connections can be emphasized by stressing the need to learn math skills and by using instructional strategies that require students to apply these skills. Students are supported in this work when the teacher emphasizes interdisciplinary connections and mathematical thinking.

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PARTIALLY PROFICIENT RATING LEVEL

PROFESSIONAL PRACTICES: THE TEACHER:

- ***Emphasizes to students why they need to learn math content and skills.***

Many students fail to make the connections between learning math and their everyday lives. Some may even develop "math anxiety" because they do not think they are "good" at math or fail to see the usefulness of knowing math content and skills. Therefore, it is critical for teachers at all grade levels and in all content areas to recognize opportunities to emphasize the importance of learning math.

Mathematics enhances students' problem solving skills by providing the tools they need to think logically: define the problem, think of ways to solve it, implement a solution, and evaluate the results. Without math skills, students may find it hard to read maps, calculate taxes and percentages while shopping, create a budget, learn musical notes, or keep score in sporting events. In addition, many professions rely heavily on math skills: architects, contractors, landscape architects, engineers, and carpet and paint sales personnel. By communicating these uses and connecting them to the content being taught, the teacher can emphasize why students need to learn math content and skills.

- ***Uses instructional approaches that require students to apply and transfer mathematical knowledge to different content areas.***

An effective way to emphasize the importance of learning math content and skills is by using instructional approaches that require students to apply these skills in different content areas.

Examples of transferring math knowledge to different content areas:

- Science
  - Creating graphs to present data collected from experiments or observations
  - Measuring weight, distance, size, and/or temperature of objects
- Social studies
  - Reading maps by using scales to calculate distance between locations
  - Calculating unemployment percentages and determining who is not counted in the reported figures and the impact this has on communities
  - Applying proportional reasoning to analyze a problem in the community (e.g., unemployment)
- Art
  - Applying measurement skills
  - Applying math to photography or set design
- Physical education
  - Counting by ones, twos, etc., as students do warm-up exercises
  - Measuring distances on a basketball court, baseball diamond, or obstacle course
  - Using formulas to calculate winning percentages, batting averages, or runners' distances and

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speeds

- Music
  - Applying math to rhythmic concepts
  - Applying mathematical thinking, problem solving, and logic through tempo

Refer to these external resources for additional information:

- Website: AIMS Education Foundation
  http://www.aimsedu.org/cms/free/free-sample-activities/1.html
  Website provides sample lessons for integrating math strategies into the teaching of science.
- Website: PE Central
  http://www.pecentral.org/lessonideas/searchresults.asp?category=55
  Website provides lesson ideas for integration of other content areas, including math, into physical education classes.
- Website: Math Songs, Teaching Math Facts & Concepts maintained by Songs for Teaching
  http://www.songsforteaching.com/mathsongs.htm
  Website provides a list of songs that can be used to integrate math concepts and skills.
- Website: Mathematics in Music sponsored by Pearson Education, Inc.
  https://www.teachervision.com/math/resource/10340.html
  Website provides sample lesson plans that incorporate math strategies into the teaching of music.
- Article: "You're Not In Math Class Anymore: Integrating Math Across the Curriculum" by Linda Starr Education World
  http://www.educationworld.com/a_curr/curr146.shtml
  Article provides ways math can be connected to students' everyday lives and to other disciplines.

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