

Professional Development Module

Title: Teaching Fractions in Grades 3 - 6

Content and Instructional Shifts: K-5

Targeted Audience: Teachers in grades 3-6

Grade Span: 3-6

Description: Instructor notes; handouts; implementation assignments – based on *Extending Children's Mathematics: Fractions and Decimals* by Empson and Levi

Delivery time: Session 9 of 10 three-hour sessions

The following materials were designed with the intent that the presenter(s) would be educators who have a deep understanding of the mathematical content being addressed at this level.

Session 9 Instructor Notes:

Learning Goals:

- Teachers will understand the content and instructional shifts for teaching fractions resulting from adoption of *Iowa Core Mathematics*.
- Teachers will understand the grade-specific expectations and cross grade-level learning progressions of the *Iowa Core Mathematics* fraction standards.
- Teachers will understand and implement research-based instructional strategies to build students' understanding of fractions and algebra.

Success Criteria:

- Teachers will explain teacher actions to help students develop the Standards for Mathematical Practice when teaching fractions.
- Teachers will analyze sample assessment items on fractions from the Partnership for Assessment of Readiness for College and Careers (PARCC) and the Smarter Balanced Assessment Consortium (SBAC).
- Teachers will study “Progressions for the Common Core State Standards in Mathematics (draft) Number and Operations—Fractions, 3–5.”

Time: 3 hours

Materials:

- Book *Extending Children's Mathematics: Fractions and Decimals* by Empson and Levi
- Handout “Iowa Core Mathematics Content and Practice Shifts Grades K-5”
- Handout “Iowa Core Mathematics Standards for Mathematical Practice”
- Handout “IC Map on SMP for Fractions”
- Handout “Progressions for the Common Core State Standards in Mathematics (draft). Number and Operations—Fractions, 3–5”
- Instructor Resource “IC Map on SMP for Fractions Complete”
- Instructor Resource “Front Matter for Progressions for the Common Core State Standards in Mathematics (draft)”
- Student work collected by each participant
- Participants' laptops
- Internet connection for all participants

Session 9 Activity 1
Analyze Student Work from Implementation Assignment 7

Approximate Time: 50 minutes

Key Purpose: To reflect on teacher actions during the last implementation assignment.

Materials:

- Student work collected by each participant

Activity Description	Key Discussion Points
<p>Analyze Implementation Assignment</p> <p>Place participants into grade-alike groups. Have participants share the following:</p> <ul style="list-style-type: none"> • What problem and number choices did you use? • What did you notice about your student’s thinking? • What did you discuss as a class? • What did you learn as a teacher? • What are your next steps? 	<p>Analyze Implementation Assignment</p> <p>As participants work in groups, note examples of evidence of students’ understanding of fraction computation. Ask select teachers to share their student’s work and thinking with the entire class.</p>

Session 9 Activity 2
Content and Practice Shifts for Fraction Computation

Approximate Time: 30 minutes

Key Purpose: To summarize the content and practice shifts for teaching fraction computation.

Materials:

- Handout “Iowa Core Mathematics Content and Practice Shifts Grades K-5”

Activity Description	Key Discussion Points
<p>Content and Practice Shifts for Fraction Computation</p> <p>Part of the assignment for Session 9 was to read the shifts under “Fraction Computation” (pp. 12-15) of “Iowa Core Mathematics Content and Practice Shifts Grades K-5” (handout from Session 1). Ask participants the following questions:</p> <ul style="list-style-type: none"> • What do you think are the most significant shifts? • Which shifts do you think will be the most challenging to implement? • If implemented, how do you think these shifts will impact student understanding and student achievement? 	<p>Content and Practice Shifts for Fraction Computation</p> <ul style="list-style-type: none"> • This document only addresses grades K-5, so the sixth grade standard on dividing fractions is not included. • We hope participants will note the importance of the following ideas: <ul style="list-style-type: none"> ○ Using contextual problems to build understanding of fraction computation. ○ Visual fraction models help develop understanding of fraction computation. ○ Unit fractions are the building blocks of understanding fraction computation. ○ Composite fractions are multiples of unit fractions.

- The properties of operations should be applied to fraction computation.

Session 9 Activity 3
Standards for Mathematical Practice

Approximate Time: 60 minutes

Key Purpose: To connect research-based practices for teaching fractions to the Standards for Mathematical Practice.

Materials:

- Handout “Iowa Core Mathematics Standards for Mathematical Practice”
- Handout “IC Map on SMP for Fractions”
- Instructor Resource “IC Map on SMP for Fractions Complete”

Activity Description	Key Discussion Points
<p>1. Standards for Mathematical Practice (SMP) Pass out “Iowa Core Mathematics Standards for Mathematical Practice” (handout) and have participants read the introductory paragraph at the top of first page. Discuss the source of these practices and the intended grade levels.</p> <p>Have participants read the paragraph under the heading “Connecting the Standards for Mathematical Practice to the Standards for Mathematical Content” on the third page. Discuss the importance of embedding the practices into all mathematical content areas.</p>	<p>1. Standards for Mathematical Practice (SMP)</p> <ul style="list-style-type: none"> • The SMP apply to all grades K-12. • The SMP are not new ideas, but based on best practice since the late 1980s. The National Council of Teachers of Mathematics (NCTM) <i>Curriculum and Evaluation Standards</i> were originally published in 1989 and revised as <i>Principles and Standards for School Mathematics</i> in 2000. The National Research Council’s report <i>Adding It Up</i> was published in 2001. • The SMP apply to all content areas including the teaching of fractions.
<p>2. IC Map</p> <ol style="list-style-type: none"> Pass out “IC Map on SMP for Fractions” (handout) and discuss the purpose of an Innovation Configuration (IC) map listed on the front page. Have participants read SMP 1 from “Iowa Core Mathematics Standards for Mathematical Practice” (handout) and component 1 from “IC Map on SMP for Fractions” (handout). Have participants reflect on their teaching actions in regard to teaching fractions and SMP 1. Complete the bottom half of page 2 as a group. Place participant in groups of 2 or 3 and give the following directions: <ul style="list-style-type: none"> ○ Select two practice standards (not SMP 1). ○ Read the description of each selected SMP from “Iowa Core Mathematics Standards for Mathematical Practice” (handout) 	<p>2. IC Map</p> <p>The purpose of this activity is to show how the instructional practices for teaching fractions promoted in this course fit the Standards for Mathematical Practice. To facilitate discussion around those connections we are using an IC Map.</p> <ol style="list-style-type: none"> It is important to note the IC map focuses on teacher actions, not student actions. The focus is what teachers can do to help students develop each practice. As participants share examples of exemplary and unsatisfactory actions for SMP 1 record the actions. “IC Map on SMP for Fractions Complete” (instructor resource) includes a completed IC Map for teaching fractions. Use this document to fill in gaps. You may want to assign 1 or 2 SMP to each group or allow groups to choose the SMP they want to address.

- and from “IC Map on SMP for Fractions” (handout).
- Describe specific teacher actions for each selected SMP in regard to teaching fractions. Describe both “Exemplary” and “Unsatisfactory” actions. Record your actions in the empty cells.
 - Prepare to share your work with the class.
- d. Conduct a whole class discussion of each SMP. Have participants who worked on each SMP, share the teacher actions they recorded.

- d. We hope participants note several of the examples provided in “IC Map on SMP for Fractions Complete” (instructor resource). As before, use the document to fill in gaps during the discussion.

**Session 9 Activity 4
Assessment**

Approximate Time: 30 minutes

Key Purpose: To become aware of sample assessment items for Common Core State Standards in Mathematics.

Materials:

- <http://dese.mo.gov/college-career-readiness/assessment/smarter-balanced/sbac-sample-items>
- <http://www.parcconline.org/samples/item-task-prototypes>

The homework assignment for Session 9 requested participants bring a laptop to explore websites. Invite participants to choose and access the Partnership for Assessment of Readiness for College and Careers (PARCC) and/or the Smarter Balanced Assessment Consortium (SBAC) website and review test items related to fractions. As participants review items have them consider the following questions:

- What do students need to understand to be successful with specific sample items?
- How do the items compare to *Iowa Assessment* items or other standardized assessments you give?
- How do the items compare to classroom or district assessments you use?
- Find items you think will challenge your students. What about the item will be challenging? Why?
- Find items you think will be more routine for your students. What about the item makes it routine? Why?

The purpose of this activity is for teachers to become acquainted with the types of items created to measure student understanding of *Common Core State Standards for Mathematics* fraction standards. Some teachers may be familiar with these sites and others may not. Teachers will not have enough time to thoroughly explore all sample items.

Answers will probably vary with among teachers. We hope teachers recognize students need more than a procedural knowledge of fractions to be successful with many of the PARCC and SBAC items. We also hope this activity will encourage teachers to reflect on their classroom and district assessment items and how well they align with measuring fraction understanding at a deep level.

**Session 9 Activity 5
Assignment**

Approximate Time: 10 minutes

Materials:

- Session 8 Assignment Sheet
- Instructor Resource “Front Matter for Progressions for the Common Core State Standards in Mathematics (draft)”

Activity Description	Key Discussion Points
<p>1. Reading Assignment:</p> <ul style="list-style-type: none"> • “Progressions for the Common Core State Standards in Mathematics (draft). Number and Operations—Fractions, 3–5” • Take notes on the ideas you feel are most important when teaching fractions. Also keep a list of any questions you might have. Be prepared to discuss your thoughts. <p>2. Items needed for Session 10:</p> <ul style="list-style-type: none"> • Bring your textbook and any other resources you use to teach fractions. • Bring a laptop in order to record your work in a Word document. 	<p>The first draft of the Progressions documents were written before the Common Core State Standards. “They note key connections among standards, point out cognitive difficulties and pedagogical solutions, and give more detail on particularly knotty areas of the mathematics.” (Front Matter for Progressions for the Common Core State Standards in Mathematics (draft), page 4).</p> <p>As the instructor, you may want to read the instructor resource, “Front Matter for Progressions for the Common Core State Standards in Mathematics (draft).” This will provide background knowledge on the Progressions document.</p> <p>Participants will use the majority of class time during Session 10 to develop a plan for teaching fractions. First participants will analyze current resources and then decide how to supplement those resources.</p>