

**Fraction Reasoning in the Classroom: Ongoing Assessment and Instruction  
For Teachers of Grades 3-8  
Camel's Hump Middle School, Richmond, VT**

**Dates:** Summer Class Dates: June 21-23, and August 17(snow storm make-up day),2017  
(Wednesday-Friday), 8:00 - 4:30

School Year Follow-Up Dates: September 28 and October 26, 2017, 3:30-6:30

**Instructors:** Mary Abele-Austin  
Chittenden East SU  
802-522-4202  
mary.abeleaustin@cesuvt.org

Karen Reinhardt  
Chittenden East SU  
802-522-0300  
karen.reinhardt@cesuvt.org

**Description:** The ability to reason fractionally, compare and order fractions, understand the part/whole relationship and operate with fractions is essential for students in elementary and early middle grades to access the mathematics expected of them in middle school. Fractional reasoning is the cornerstone concept for intermediate mathematics knowledge and the foundation of middle school mathematics. The Fractional Reasoning Course is a professional development opportunity for teachers based on the cognitive research currently available on misconceptions and developing understandings for students in fractional reasoning. Teachers will become familiar with the cognitive research by interacting with materials developed through an NSF grant, which make the research transparent and explicit for use in classrooms. Teachers will provide intensive math instruction for students in their own classrooms by modeling and putting into practice strategies and content learned in the class. Teachers will assess their students' understanding in the area of fractional reasoning and develop instructional strategies to address student misconceptions and developing understandings. They will work closely with their colleagues to analyze the ongoing information they collect and to develop intervention strategies to increase their students' understanding. There will be a direct link between the research, instructional methods, and the CCSS-M.

**Methodologies:** This course will incorporate a variety of teaching strategies with the purpose of modeling research-based best practices. There will be lecture, discussion, small group collaborative learning, participant presentations, and constructed understanding through teacher facilitation and modeling.

**Course Goals and Objectives:**

- To provide familiarity with CCSS related to fractional reasoning
- To understand current research on student misconceptions and developing understandings of fractional reasoning
- To understand and use ongoing assessment strategies and tools for the purpose of making instructional decisions
- To examine materials and methods for teaching mathematics related to fractional reasoning

- To collaborate with colleagues to plan, deliver, and evaluate instruction
- To increase understanding of methods that allow teachers to meet the needs of a diverse population of students in the regular classroom
- To increase ability to examine student work to understand student knowledge and inform instruction
- To become familiar with gaps in program materials related to fractional reasoning research and plan for addressing them

**Course Requirements:**

- Assigned readings and responses
- Implementation of formative assessment practices
- Implementation of the OGAP Fractional Reasoning Materials
- Documentation of classroom implementation
- Reflection on and sharing of classroom implementation
- Attendance and active participation

**Text:** Petit, M., Laird, R., Marsden, T., Ebby, C. (2016). *A Focus on Fractions: Bringing Research to the Classroom Second Edition*. New York, NY: Routledge Group

In addition, participants will be expected to read a variety of current articles on fractional reasoning, teaching fractions, effective instructional strategies, CCSS expectations and ongoing assessment strategies.

Teachers will fully implement the materials developed through the NSF grant: OGAP (Ongoing Assessment Project) for Fractional Reasoning, which are based on cognitive research about students' understanding of fraction reasoning.

**Additional Readings:**

Fosnot, Catherine, Dolk, Marteen, *Young Mathematicians at Work: Constructing Fractions and Decimals*, Chapters 3-6, 2003

Behr, M., & Post, T., Teaching Rational Number and Decimal Concepts. *Teaching Mathematics in Grades K-8: Research-based Methods*, p.201-248

Behr, M.J., Wachsmuth, I., and Post, T.R., (1995). Construct a Sum: A measure of children's understanding of fraction size. *Journal for Research in Mathematics Education*, 16, 120-131

Empson, Susan B. and Levi, Linda. *Extending Children's Mathematics: Fractions & Decimals: Innovations In Cognitively Guided Instruction*. Heinemann 2011

Kamii, C., Warrington, M., Teaching Fractions: Fostering Children's Own Reasoning. *1999 NCTM Yearbook: Developing Mathematical Reasoning in Grades K-12*, p. 82-92

Lamon, S. (2005). *Teaching Fractions and Ratios for Understanding: Essential content and instructional strategies for teachers*. Mahwah, NJ: Lawrence Erlbaum Associates.

Van de Walle, J., Chapter 12 and 13: Fractions Concepts and Operations. *Elementary and Middle School Mathematics*, 2002

**Primary topic(s) planned for each day.**

Date	Topics
Day 1 8:00 - 4:30	Sessions 0, 1, 2, 3 Requirements, What is fractional reasoning? Ongoing assessment for the purpose of informing instruction, Inappropriate Whole Number Reasoning CCSS as they relate to fractional reasoning, Models for fractional reasoning, Developing understanding around equivalence, examining student work using the OGAP framework
Day 2 8:00 - 4:30	Sessions 4, 5, 6 Comparing and Ordering fractions, examining student work Partitioning with Models, Using Number Lines to make sense of fractions, review of teaching materials and examining student work using the OGAP framework
Day 3 8:00 - 4:30	Session 7, 8, 9, 10, 11 Fractions and the Common Core State Standards, link to curricular materials, Operations Overview, Relationship between decimals and fractions, Decimal Operations, Decimal Maze, examining student work using the OGAP framework, Addition and Subtraction, What's the Whole, examining student work using the OGAP framework
Day 4 8:00 - 4:30	Session 12, 13 Multiplication of Fractions, examining student work using the OGAP framework, Division of Fractions,
Follow up Sept. 28 3:30-6:30	Analyzing Pre-assessment tasks Session 14, 15 Density of Fractions and Navigating the OGAP Fraction Item Bank,
Follow up Oct. 26 3:30 - 6:30	Finish Session 15, Navigating the OGAP Fraction Item Bank, sharing of final projects

### **Assignments/Grading Criteria**

- Attendance at each class/class participation (30 points)
- Course Portfolio that includes: (25 points total)
  - All materials used and developed in the course organized in a way that ensures easy access in the future (5 points)
  - Reflective responses to readings (20 points)
- Classroom Portfolio that includes: (20 points total)
  - Pre-assessment and ongoing reflection on student growth in reasoning based on formative assessment of student work samples (10 points)
  - Journal documenting and reflecting on teacher decisions, instructional changes, and observations of student understanding based on understanding of the cognitive research and implementation of OGAP formative assessment materials (10 points)
- Final Presentation of classroom implementation of fractional reasoning instructional unit, and data about increased student learning through the analysis of pre- and post-assessments (25 points)