



CORE: K-2 Course 2: Early Operations

EDUO 9340

1 Semester Credit/Unit

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Syllabus

Course Overview

Counting and Number Relationships is the second course in a series of three courses focused on the Foundations of Numeracy. These courses support K-2 educators in developing a deeper understanding of the mathematical content and pedagogy that leads to student proficiency with early number sense.

Course Learning Objectives:

Content and Concepts

In this course you will:

- Make sense of how facts and procedures connect to concrete and visual models for addition and subtraction.
- Learn and reflect on use and choice of strategies for addition and subtraction, such as counting on or counting back, thinking of part-part-whole relationships, use of benchmarks, and use of number facts.
- Analyze strategies that allow students to decompose numbers in order to compute addition and subtraction problems.
- Explore the meaning of the equal sign and how it relates to algebraic reasoning.
- Write number sentences that match how students think about the story line (semantic structure) for small number addition and subtraction problems.
- Examine the different “problem types” students need to practice working with.
- Recognize the importance of building fluency with operations and key steps in student progression toward fluency.

Pedagogical Content Knowledge

- Recognize that how students learn and work with math has a strong impact on what they learn about math.
- Apply and connect the Concrete, Pictorial, Abstract (CPA) sequence and strategies to build an understanding of numbers.
- Recognize the importance of varied and consistent practice with models, explanations, number relations, and counting.
- Focus on equitable practices which provide access for all students to reach proficiency in mathematics during grades K–2.
- Learn strategies to address common challenges.
- Gain ideas for activities you can use in the classroom.
- Connect to valuable resources to enhance your knowledge and provide additional ideas and activities for teaching and learning.

Course Organization

The course is divided into eight modules (numbered 0–7). Each week you will be assigned two modules to complete at your own pace. You may complete more than is scheduled in a week, or you may sometimes lag a bit behind due to your personal schedule that week. If you fall behind, it is important to catch up as soon as possible. If you work ahead, then it is important to return to discussions in modules you completed to reply to responses from your colleagues. Although this is an asynchronous course it is “self-paced” within specific pacing guidelines (two modules per week). Your course facilitator will check in with you from time-to-time, add comments to discussions, and make sure you are okay if you happen to fall behind. The course includes a pre-assessment and post-assessment of your knowledge of the teaching and learning of counting and number relationships in grades K–2. At the beginning of the course, you will be given an application assignment (with three options for the type of application assignment to complete) that must be completed and uploaded by the end of the course, but may be completed and uploaded at any time throughout the course.

Each module focuses on one or two big ideas around early operations in grades K–2. The course, modules, and sections generally follow a launch—explore—summarize instructional model. Within the focus on each big idea standard elements appear within the modules:

1. Initial ideas around a key concept
2. Sharing information, research, and resources
3. Descriptions of student-facing activities
4. Knowledge checks
5. Discussions
6. Journal entries
7. Exploration of ideas or resources—especially examples of learning through the concrete-to-pictorial-to-abstract (CPA) approach.
8. End-of-module assessment.

Schedule

- Week 1 complete Modules #0 & 1
- Week 2 complete Modules #2 & 3
- Week 3 complete Modules #4 & 5
- Week 4 complete Modules #6 & 7

Work time

Average time typically spent working on the course is about four hours per week or two hours per module. Overall, the course is expected to take 15–18 hours to complete.

Grading

This is a pass/fail course unless otherwise requested. You are allowed multiple attempts to complete assignments if you would like to improve your score. Grading is based on the following assignments:

- Four discussions
- Six journal entries
- Six end-of-module summary assessments
- One Application Assignment
- Completion of pre- and post-assessments

Course Outline/Learning Modules

The modules are designed to deliver content in a sequence that builds in complexity while showing coherence from kindergarten through second grade.

Module 0: Introduction, Orientation, and Foundations

Learn about how the course is set up, assignments, routines for learning, navigating the course, completing knowledge checks regarding learning routines, introduce yourself to colleagues, and complete a course pre-assessment. Also, dive into background information that is important content and pedagogical foundations for the course.

Sections and Lessons for Module 0: Introduction, Orientation, and Foundations

Sections	Lessons
Course Welcome	Lesson 1: Welcome to the Early Operations Course
Course Orientation	Lesson 1: Orientation Introduction Lesson 2: Routines for Learning and Sharing Lesson 3: Choice and Optional Extra Credit Discussion: Introduce Yourself Course Pre-Assessment
Research and Standards	Lesson 1: Key Points from Research on Foundations for Early Operations
Objectives and Wrap Up	Lesson 1: Focus and Objectives

Module 1: Foundations of Addition

The early stages of addition depend on advanced counting strategies. Students count and join collections, build on grouping by fives and tens, extend unitizing to 100 and 1000, utilize counting strategies with addition, and derive “new” facts from known facts. In this module we’ll look at techniques that lead toward an understanding and proficiency with addition within 20 and see how some techniques extend to work within 100 and beyond.

Sections and Lessons for Module 1: Foundations of Addition

Sections	Lessons
Foundations of Addition	Lesson 1 - Development for Understanding Addition Lesson 2 - Direct Modeling with Concrete Objects for Addition Lesson 3 - Counting Sets Using Concrete and Visual Models for Addition
Counting Strategies and Number Facts	Lesson 1 - Counting-on From First vs. Counting-on From Larger Lesson 2 - Number Fact Strategies with Addition Journal: Connecting National Council of Teachers of Mathematics (NCTM) recommendations to the Concrete-to-Pictorial-to-Abstract (CPA) Approach
Using Benchmarks 5 and 10	Lesson 1 - Make the Number Routine from Melissa Conklin Lesson 2- Progression of Learning with Benchmarks and Ten-frames Lesson 3 - Explore Student-facing Activities with Benchmarks 5 and 10 Lesson 4 - Counting Sets and Joining Sets Lesson 5 - Explore Ten-frame Filler Game
Module 1 Summary	Lesson 1 - Summary of Foundations for Addition Module 1 Summary Assessment

Module 2: Foundations of Subtraction

In this module we'll focus our attention on working toward proficiency with subtraction. We'll see that many of the techniques used with addition are used with subtraction. We'll also see how some of the techniques differ when applied to subtraction. The big idea to keep on everyone's radar is that addition and subtraction are related, and it is vital for students to see the connections.

Sections and Lessons for Module 2: Foundations for Subtraction

Sections	Lessons
Subtraction: Counting to Separate and to Compare	Lesson 1 - Introduction to Foundations for Subtraction
Direct Modeling Strategies for Subtraction	Lesson 1 - Direct modeling strategy- Separating (take away) Lesson 2 - Direct modeling strategy- Comparing
Counting Strategies for Subtraction	Lesson 1 - Counting Strategies for Subtraction Lesson 2 - Direct Modeling Connected to Counting Strategies for Subtraction Lesson 3 - Number Fact Strategies Discussion: Making Connections to Relationship Between Addition and Subtraction
Subtraction Activities	Lesson 1 - Explore Student-facing Activities for Subtraction
Module 2 Summary	Lesson 1 - Summary of Foundations for Subtraction Module 2 Summary Assessment

Module 3: Operation Sense in the Quantifying Phase

In this module we'll examine learning in the Quantifying Phase as it relates to building understanding with operations or "operation sense." To build operation sense we will continue to look at a progression that develops through connections from concrete to pictorial (visual) to abstract (symbolic and numerical) representations of mathematical ideas and procedures.

Sections and Lessons for Module 3: Operation Sense in the Quantifying Phase

Sections	Lessons
Operation Sense	Lesson 1 - Introduction to Operations Sense
Strategies to Support Operation Sense	Lesson 1 - Strategies to Support Building Operation Sense Lesson 2 - Linking Cubes Lesson 3 – Number Bonds with Addition Lesson 4 – Number Bonds with Subtraction Lesson 5 – Challenges with Subtraction Lesson 6 – Double Ten-frames with Number Bonds Lesson 7 - Summary of Number Bonds Journal: Highlights About Number Bonds
Strategies with Other Models	Lesson 1 - Introduction to Other Models Lesson 2 - Tape Diagrams Lesson 3 - From Number Paths to Number Lines
Module 3 Summary	Lesson 1 - Summary of Operation Sense in the Quantifying Phase Module 3 Summary Assessment

Module 4: Equality

In this module we'll highlight the meaning of and common misconceptions with equality and explore activities to help students make sense of the idea of equal amounts. Equality is a central idea in mathematics that students begin to grasp in the primary grades. It is an idea with complexity built into its very simplicity.

Sections and Lessons for Module 4: Equality

Sections	Lessons
Equality	Lesson 1 - Introduction to Equality Lesson 2 - What Is Equality? Lesson 3 - Explore Student Facing Activities for Understanding Equality Lesson 4 - What Does the Equal Sign Mean? Lesson 5 - Explore Student Facing Activities to Support Equality in the Abstract Stage Journal: Benefits and Challenges of Student-facing Activity
Module 4 Summary	Lesson 1 - Summary of Equality Module 4 Summary Assessment

Module 5: Comparing and Relating Numbers in the Quantifying Phase

In this module we'll examine the basic operations of addition and subtraction and their quantitative relationships that can be modeled in word problems. In the Quantifying phase, students develop meanings for addition and subtraction as they encounter problem situations in Kindergarten, and they extend these meanings as they encounter increasingly complex problems situations in First and Second grade ([CCSS Progressions](#)).

Sections and Lessons for Module 5: Word Problems in the Quantifying Phase

Sections	Lessons
Word Problems	Lesson 1 - Welcome to Word Problems in the Quantifying Phase
Understanding Problem Types	Lesson 1 - Overview of Problem Types Lesson 2 - Add-to (Join) Problem Types Lesson 3 - Take-from (Separate) Problem Types Lesson 4 - Part-Part-Whole Problem Types Lesson 5 - Compare Problem Types
Missteps and Opportunities	Lesson 1 - Common Missteps with Teaching with Problem Solving Lesson 2 - Opportunities for Developing Problem-Solving Reasoning Journal: Connect Numberless Word Problems to Operation Sense
Module 5 Summary	Lesson 1 - Summary of Word Problems in the Quantifying Phase Module 5 Summary Assessment

Module 6: Building Fluency

In this module we'll look at what fluency means, different aspects of fluency, and strategies for reaching fluency with grade level content. We will also look at many different activities you can use and adapt with students.

Sections and Lessons for Module 6: Building Fluency

Sections	Lessons
Introduction to Fluency	Lesson 1 - Welcome to Building Fluency Lesson 2 - Developing Fluency Lesson 3 - Learning Addition and Subtraction Facts Discussion: Frankenstein Fluency Statement
Explore Fluency Activities	Lesson 1 - Benefits of Fluency Activities Lesson 2 - Verbal Fluency Activities Lesson 3: Written Fluency Activities Lesson 4: Processing and Assessing Lesson 5: Website Resources for Fluency Activities Journal: Share Analysis of a Website Resource Fluency Activity
Module 6 Summary	Lesson 1 - Summary of Building Fluency Module 6 Summary Assessment

Module 7: Course Review and Wrap-up

In this course wrap-up module, we will review the course objects and some key ideas, and then connect learning to “Big Ideas” in math. We will also share a list of activities and a list of website resources in the course. Finally, you can complete and upload your Choice Assignment if you have not done so already; complete a course post-assessment; and complete the course feedback survey.

Sections and Lessons for Module 7: Course Review and Wrap Up

Sections	Lessons
Course Review	Lesson 1 - Review of Early Operations Journal: Connect Learnings to “Big Ideas”
Course Activities and Resources	Lesson 1 - Activity and Resource Charts Course Post-Assessment Complete and Upload Choice Application Assignment
Final Remarks and Feedback	Lesson 1 - Concluding Remarks Provide Course Feedback