

## Title

Understanding Counting and Numbers (Grades K-2)

## Target Audience

This course is designed for pre-service and in-service grades K-2 teachers.

## Facilitator

TBA

## Prerequisites

To successfully participate in this course, you should be familiar with taking an online course or have completed the TeacherLine Practice Learning Online Course. You should also be familiar with primary elementary mathematics content. To fully participate in applying all of the strategies in this course, the learner will need to have access to a class or small group of primary students

## Credits

To be decided by university

## Course Description

This course explores activities specifically designed to support multiple-intelligences and constructivist theories within the curriculum and help students meet the National Council of Teachers of Mathematics (NCTM) standards. Through articles, multimedia, discussion forums, and online reflections the learner will gain knowledge about how children learn to count and develop strategies for enhancing student success in counting and understanding our number system. Learners will enhance their content knowledge, teaching pedagogy, and improve student achievement. As a final task, learners will incorporate what they have learned into a lesson plan designed to teach counting and numbers to their students.

## Goals

Learners will interact with a variety of strategies for teaching counting and numbers to kindergartners through second graders, while addressing the NCTM Standards for teaching numbers. The strategies and their assignments are presented in increasingly higher levels of critical thinking and are spiraled throughout the course. For instance, multiple intelligences are presented in Part 2, and subsequent parts address a variety of intelligences. The individual parts integrate constructivist learning theory by providing learners with opportunities to access their prior knowledge, apply critical thinking skills, participate in discussions with others, and reflect on their learning. As a final task, learners will synthesize the strategies in an original lesson plan about counting and numbers. Alternatively, the learners might choose to complete three concise projects throughout the course:

- planning an original activity about number words and numeral recognition that uses physical models and representations
- creating a hands-on activity in which students use manipulatives to represent fractions
- creating an original activity in which students use manipulatives to learn place value

### Learner Outcomes

Learners completing the Understanding Counting and Numbers (Grades K–2) course will:

- demonstrate an understanding of the NCTM Number and Operations Standard and discuss the underpinnings to the developmental needs of primary children;
- address multiple intelligences while teaching counting and numbers;
- apply hands-on activities for teaching fractions in which students problem solve and reflect on their learning;
- utilize the constructivist learning theory in a counting and numbers lesson plan.

*Technology Goals:* Through participation in this course, learners will achieve the following:

- Use technology resources to engage in ongoing professional development and lifelong learning (NETS\*T V.A.).
- Use technology to communicate and collaborate with peers in order to nurture student learning (NETS\*T V.D.).

### Outline of Content and Assignments

After previewing the Course introductory information, learners will proceed to the Assignments section to complete the following six parts, working through each part in order. Essential information pertaining to the topic is presented at various points within the course. For example, in Part 1 a research-based article focuses on the course content and pedagogy and sets the stage for the entire course. Throughout the parts, learners are asked to articulate their ideas in various forms. They are encouraged to reflect on their ideas and experiences in their TeacherLine Journals. The weekly Discussion Boards are designed to foster the sharing of ideas and strategies. Learners are given a final project to develop a counting or numbers lesson plan that applies strategies from the course and can be used in their classroom.

The course is designed to address the mathematics of understanding counting and numbers as described in the National Council of Teachers of Mathematics (NCTM) *Principles and Standards for School Mathematics* (PSSM 2000), focusing on the expectations for kindergarten through second grade students: "Instructional programs from pre-kindergarten through grade 12 should enable all students to understand numbers, ways of representing numbers, relationships among numbers, and number systems." The PSSM 2000 reflects some of the most current research on mathematics teaching and learning, and presents a vision of instruction that should enable all students to solve challenging problems.

#### Part 1: Orientation and Introductions

In Part 1 of this course, learners will read the NCTM *Introduction to the Standards for Grades PreK–2* for an overview of mathematics for the youngest learner and mathematics education in pre-kindergarten through Grade 2. Learners will also read the NCTM Number and Operations Standard for grades PreK–2 to better understand what their students are working toward in the primary classroom.

Learners will:

- Identify at least two strategies for teaching counting, based on the NCTM Number and Operations Standard.
- Explain and give examples of how developmental theories have influenced the NCTM Standards.
- Identify processes of the learning cycle that are important in early childhood education.

Test their computer

- Click “Check Your Computer” to install all required plug-ins to run PBS TeacherLine courses. (“Check Your Computer” is located in the lower left-hand corner of the screen accessible after logging in and clicking on “My Courses.”)

Become familiar with the course website

- Click on the different sections of the course.
- Watch "Launch Video," a short, informative video about preparing yourself to think like a learner as well as a teacher for this course.
- Run the “Launch Applet” program.
- Print out the Digital Drop Box instructions for later use in Parts 2-6.

Read

- “Introduction to Standards for Grades Pre-K–2”  
This section of NCTM's *Principles and Standards for School Mathematics* (PSSM 2000) describes the developmental level and mathematical learning needs of primary students.
- “Number and Operations Standard for Grades Pre-K–2”  
The section of NCTM's *Principles and Standards for School Mathematics* (PSSM 2000) describes the expectations for grades Pre-K–2 for understanding numbers, meanings of operations, and computing fluently.
- “How Concepts Develop in Mathematics”  
The reading outlines the concepts children are developing and how young children acquire knowledge.

Write in online journal

- Think of two everyday examples that you use to teach counting.
- What two strategies from this standard can you use to teach counting and numbers?
- Current standards support a constructivist approach to learning. What are the four processes of the learning cycle that are important in early childhood education?

Participate in online discussion

- Introduce yourself on the Discussion Board by sharing your name, where and what you teach, and other information you would like to include about your teaching experience. Participate in an icebreaker activity related to the content of the course, but with the intent of being fun so all the learners begin to interact naturally.
- A child demonstrates mathematical knowledge by asking for the book with three cats on the cover. Think about and share other real-life situations that demonstrate children's knowledge of counting or numbers.
- Refer to your reflection related to Reading 1, Introduction to the Standards for Grades Pre-K–2. Use one of your examples from this reflection and share ways you can foster mathematical development in this situation.

Review Final Project

- Read about the final project and the alternative 3-part project. Begin to think about how to approach this. Read the assessment rubrics for the final project and the alternative project.

Additional Resources (optional)

- Working with Diverse Learners  
Offers suggestions for students who need extra help.
- “Improving Student Achievement in Mathematics”  
The article offers ten recommendations for improving mathematics achievement in the classroom.

Part 2: Multiple Intelligences and Counting

Learners will:

- Describe effective strategies, based on current research, for teaching counting.
- Describe five key principles children must use in order to count accurately.
- Identify multiple intelligences addressed in several counting activities.
- Discuss counting activities that address multiple intelligences while strengthening student understanding of counting.

Read

- “The Mathematical Knowledge Children Bring to School,” from *Adding It Up: Helping Children Learn Mathematics*, pages 158-163.  
This reading describes young students’ conceptual understanding of number and counting.
- “How to Teach Counting”  
The article applies what we know about children’s concepts of numbers and counting, and about multiple intelligences to describe how to teach children to count.

Complete activities

- Download and print a copy of the Multiple Intelligences chart. Refer to it as you watch the different intelligences depicted in the video.
- View the video “Multiple Intelligences and Counting” that shows how teachers address multiple intelligences when teaching counting.
- Complete a self-scoring quiz by interacting with an applet in which the learner will identify the intelligence being addressed in a variety of activities.

Write in online journal

- What difficulties do your students have when they count?
- Counting objects accurately is a complex task for young children. Describe what children must do in order to count accurately.

Participate in online discussion

- What are some effective strategies for helping young students learn to count and to develop their concept of *number*?
- How can you address multiple intelligences when teaching children how to count?
- In “The Mathematical Knowledge Children Bring to School,” you read about three principles of mathematical counting: *one-to-one*, *stable order*, and *cardinal*. And in the video, you observed strategies that address multiple intelligences while supporting children who are learning to count.  
First, choose one of these principles and then think of an activity you could use in your classroom to reinforce this principle, while addressing at least two different intelligences. Discuss your ideas.

Additional resources (optional)

- “Learning Through Many Kinds of Intelligence” by Dee Dickinson  
As this article states, “When children have the opportunity to learn through their strengths, they may become more successful at learning all subjects.”

Part 3: Teaching Number Word and Numeral Recognition

Learners will:

- Describe a strategy for teaching numeral recognition.
- Discuss difficulties that children experience when learning to recognize number words and numerals.
- Explain how using physical models to teach number words and numeral recognition can be an effective teaching strategy.
- Discuss strategies for teaching numeral recognition to children.

Read

- “Reading and Writing Basic Symbols”  
The reading offers several suggestions for how to teach number recognition and writing skills.
- “The Mathematical Knowledge Children Bring to School,” pages 163-168  
The selection looks at the structure of number names in a language and how the consistency of the number names in that structure affects child learning.

Write in online journal

- How do you help students make connections between number words and numerals, and the quantities they both represent?
- How does the structure of English names for numbers affect children’s acquisition of number names?
- What problems might your students experience when learning to recognize two-digit numbers?
- In the video, you saw the teacher and children using connecting cubes to create physical models to relate number words and numerals to the quantities they represent. Tell why you think this strategy can be effective, and describe how you would adapt it to your classroom.

Complete activities

- View the video “Using Physical Models And Representations” to see how a teacher uses manipulatives with second-grade students to teach number words and numeral recognition.
- Complete a self-assessment. Learners will take a self-scored quiz about using physical models and representations to teach number words and numeral recognition.

Participate in online discussion

- Based on the article by Baroody, discuss the following.
  1. Which strategy do you believe would be most effective in teaching numeral recognition?
  2. How can you apply this strategy in your classroom?
  3. Do any of the students in this article remind you of any of your students? In what way?
- According to the article by Baroody, "Recognition and reading training should focus on pointing out the defining characteristics [of numerals]." Describe ways to teach children the characteristics of the numerals 0 through 9.
- Some children are confused by numerals such as 6 and 9. What other numerals might be confusing to children? Describe some strategies for helping these students distinguish numerals.

Alternative Final Project (Part 1 of 3)

- Read the Alternative Final Project Assessment Rubric.
- Create an original activity about number word and numeral recognition that uses physical models and representations.
- Due the end of Part 3.
- Send to your facilitator through email or the Digital Drop Box.

Additional resources (optional)



- “Working with Diverse Learners”  
Offers suggestions for working with second language learners.

#### Part 4: Teaching Fractions

Learners will:

- Identify strategies you can use with your students to teach fractions.
- Describe how multiple intelligences can be addressed when teaching fractions.
- Develop strategies for teaching fractional parts in a set of objects.
- Discuss effective strategies for teaching fractions.

Read

- “Rational Number Learning in the Preschool Years: What is possible?”  
The reading selection describes what children in preschool and the early years of kindergarten understand about fractions and offers strategies for teaching fractions to primary students.

Complete activities

- View the video “Using Real-life Objects to Teach Fractions” which shows how sharing food provides second graders with an authentic learning experience for understanding fractions.
- Interact with an online Fractions Game that helps children develop a basic concept of fractions by looking at objects in a set.
- Complete a self-assessment. Learners will take a self-scored quiz to see what they have learned from this part.

Write in online journal

- What common misconceptions do primary students have about fractions?
- From the video, what strategies for teaching fractions do you think would work best with your students?
- How can you use the Fractions Game or a similar strategy to help students develop the skill of finding fractional parts in a set of objects?

Participate in online discussion

- What are common experiences for young children involving fractions?
- Would you use any of the strategies presented in Reading 1 or do you have other strategies you find effective?
- Think about how you can offer primary students opportunities to apply real-life problem solving to learn about fractions. Share at least one example that you will use in your instruction that focuses on the concept of giving everyone a fair share. It could involve sharing parts of a whole object or a set of objects. In your example, state how multiple intelligences would be addressed.

Alternative Final Project (Part 2 of 3)

- Read the Alternative Final Project Assessment Rubric.
- Create a hands-on activity in which students use manipulatives to represent fractions to solve a problem.
- Due the end of Part 4.
- Send to your facilitator through email or the Digital Drop Box.

Additional resources (optional)

- Working with Diverse Learners  
Offers suggestions for working with second language learners and gifted students.

Part 5: Teaching Place Value

Learners will:

- Identify problems children encounter when learning about place value, and develop ideas, based on current research, for helping children overcome those problems.
- Explain why manipulatives are especially useful in teaching about place value.
- Discuss strategies for helping students develop a sense of place value.

Read

- “Number-Word Systems and Early Mathematical Development”  
The excerpt points out the irregularity of our numeration system and the regularity of the Asian system and discusses the impact of the systems on the children who learn them.
- “Place Value Understanding”  
The selection outlines the characteristics of children learning place-value concepts and suggests activities for young students to become familiar with the transformational relationships between the levels of the place-value hierarchy.

Complete activities

- View the video “Using Manipulatives to Teach Place Value” to see how one teacher uses manipulatives to teach place value.
- Complete a self-assessment. Learners will take a self-scored quiz to see what they have learned from this part.
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Write in online journal

- What difficulties do your students have in understanding place value?
- Which strategy suggested by Nelson do you think will be the most helpful to you in teaching your students?
- Why does Nelson believe in having children make exchanges among equivalent quantities?
- Why are manipulatives helpful in teaching the concepts of the tens place and the ones place?

Participate in online discussion

- What are the most difficult numbers for young English-speaking children to learn, and what makes these numbers problematic?
- How might the irregularities of the English number-word system impact the mathematical development of English-speaking children?
- Describe a difficulty your students have had in understanding place value. What have you learned in this part that can be useful in addressing this difficulty?

Alternative Final Project (Part 3 of 3)

- Read the Alternative Final Project Assessment Rubric.
- Create an original activity in which students use manipulatives to learn about place value.
- Due the end of Part 5.
- Send to your facilitator through email or the Digital Drop Box.

Additional resources (optional):

- “Place-Value Numeration Skills and Concepts”  
The selection outlines place-value knowledge of primary students and offers suggestions for teaching numeration skills and concepts.

Part 6: Create a Lesson Plan

Learners will:

- Identify the key elements of a good lesson plan.
- Compare and contrast a written lesson plan with how it is actually taught.
- Complete and submit a lesson plan based on the Final Project criteria provided in this part; **or**  
Complete and submit three activities based on the Alternative Final Project criteria provided in this part.

Read

- “AskERIC<sup>sm</sup> Write-A-Lesson Plan Guide”  
This reading provides an in-depth discussion of the format used to develop the lesson plans in this course. It identifies the elements of a well-designed lesson and offers suggestions for writing lesson plans.
- “Sample Lesson Plan”  
A model sample lesson using the guidelines from the first reading is provided as a reference.

Complete activities

- Download and print a lesson plan for Using Literature to Teach Ordinal Numbers. The lesson plan includes a bibliography correlated to the NCTM standard for numbers with age-appropriate children’s literature that integrates counting and numbers into the stories.
- View the video “Using Literature to Teach Ordinal Numbers” that shows a second-grade teacher conducting a lesson integrating literature and mathematics.

Write in online journal

- How do the lesson plans in this course differ from the lesson plan formats you’ve used in the past? What do they have in common?
- Before reading AskERIC Write-A-Lesson Plan Guide, reflect on what you consider to be the key elements of a well-designed lesson plan. After reading, record any additional elements that you might have overlooked.
- What elements of the lesson plan from Reading 2 were most effective and how can you incorporate these elements into the lesson plan format you currently use?

Participate in online discussion

- Compare the lesson plan and the video. Describe what you learned from watching the video that was not apparent after reading the lesson plan. How would you modify the lesson plan for your classroom and/or your teaching style?
- Read and provide feedback to at least one of your peers about his/her project. Provide constructive information that recognizes the strengths of the lesson plan or activity and provides suggestions on how you think it can be improved based on what you have learned in this course.

Final Project

- If you completed the Alternative Final Project, you do not need to complete this Final Project. However, you will need to discuss one activity with your peers.
- Read the Final Project Assessment Rubric.
- Complete the Final Project: Plan and create a 45-minute lesson plan that integrates children’s literature with a topic in counting and numbers.
- Due the end of Part 6.

- After you have discussed your Final Project with your peers, you will send it to your facilitator through e-mail or the Digital Drop Box.

Additional resources (optional)

- "Literature-Based Mathematics in Elementary School"  
The article describes the benefits of connecting mathematics and literature and how to use children's literature in teaching mathematics.
- "Children's Literature in Mathematics Instruction"  
The brief provides information about the advantages of using literature in math instruction and offers suggestions for selecting appropriate books.

## **Schedule**

This course is scheduled to take approximately 30 hours to complete readings, activities, video, assignments, reflections and a final project.

## **Requirements**

Learners are expected to:

- Complete all assignments.
- Maintain a TeacherLine Journal.
- Participate each week in discussion boards and respond to the postings of at least two other learners.
- Ask for assistance when needed.

## **Evaluation**

Pass/fail upon satisfactory completion of assignments and discussion board participation

## **Materials (hardware, software, plug-ins for Windows and Macintosh)**

### **Technical Requirements**

- Word processor
- Internet service provider
- E-mail account

## **Academic Dishonesty Policy**

To be inserted by institution