Outcomes
- To maintain a positive tone for the class by promoting conversation and success with mathematical endeavors.
- To use Cuisenaire® Rods as a manipulative for illustrating fraction concepts.
- To explore the fraction concepts of equivalence, unit and non-unit fractions, and reciprocals.
- To introduce participants to NCTM's Communication Standard.

Overview
In the fourth session of Thinking about Fractions, Decimals, and Percents, participants will use Cuisenaire® rods to continue to build on the mathematical understanding of fractions and to explore equivalence, unit and non-unit fractions and reciprocals. Unlike the pattern blocks, Cuisenaire® rods are not based on area, but rather on length. Using this manipulative gives participants the chance to deepen their understanding of fraction ideas by seeing some of the same ideas through a new model.

Time

3-5 minutes	This session opens with the introduction of NCTM's Communication Standard, which states that learners should have an opportunity to both communicate their own mathematical idea and analyze the thinking of others. During the class, they reflect on this standard.
15-20 minutes	Next participants are invited to present their homework solutions to the class. Here is an opportunity for the participants to observe the different strategies that is used in solving these problems.
65–75 minutes	In the lesson, participants use Cuisenaire® rods to investigate fraction concepts. First they compare rods to a given length. Next they compare rods to each other, always comparing a smaller rod to a larger one. The final activity has participants compare larger rods to shorter ones as a way to see reciprocal relationships. This is the most difficult portion of the lesson and may be omitted if time is short. Since the NCTM's Communication Standard is the focus of this session, a great deal of emphasis is placed on interaction between participants.
15–20 minutes	This is the final session on fractions, so in the closing activity parents reflect on the benefits of learning fractions using manipulatives.

Materials

Facilitator	Transparencies (English & Spanish)
• The **Fraction-Decimal-Percent Chart** created in Session 1 • One set of Cuisenaire® rods for the overhead projector • One chart paper with list of locations from the **List of Locations** transparency	*BLM 20: NCTM Communication Standard* *BLM 2: Math Class Web (from session 1)* *BLM 21: Measuring Map* *BLM 22: List of Locations*

Materials

Participant	Handouts (English & Spanish)
A set of Cuisenaire® rods for each participant to take home	**One transparency per group** *BLM 22: List of Locations* **One per participant for class** *BLM 21: Measuring Map* *BLM 23: Cuisenaire® Rod Relationships* **One per participant for home** *BLM 24: Bringing Mathematics Home 4* *BLM 25: Fraction Problems III*

Activities

Preparation of Classroom	Notes
1. Post the **Fraction-Decimal-Percent Charts** from the previous sessions. 2. Set up the **Chart It!** 3. Place the name cards from last class near the front of the room where participants can easily find them. 4. Have a supply of Cuisenaire® rods on the tables (do not use the tan and orange blocks) and encourage exploration of the materials as participants arrive.	It is likely that participants have been sitting together with the same groups at each class session. One way to enable them to interact with different participants is to put color dots on each name card, and then ask them to group themselves according to that color.
Connections to National Standards (3-5 minutes)	
1. Display **NCTM Communciation Standard** transparency. 2. Tell participants that the Standard for this session is **NCTM Communication Standard** which states: 　*Instructional programs from prekindergarten through grade 12 should enable all participants to--* 　• *Communicate their mathematical thinking coherently and clearly to peers, teachers, and others* 　• *Analyze and evaluate the mathematical thinking an strategies of others* 3. Let participants know that they will have a chance to practice this standard during the session.	
Discussion of Homework (15-20 minutes)	
Invite participants to share their solutions to the problems on **Fraction Problems II** (from session three). 　• Have them share with the people at their table. 　• Hand out a transparency sheet and transparency marker to each group.	If there is a group that did not present in the last class, encourage them to present this time.

Activities

Discussion of Homework (continued)	Notes
• Instruct each group to write a solution to one or more of the homework problems. • Ask volunteers to present their solutions to the class. • Remind them that they have just used the **NCTM Communication Standard**.	

Exploring Fractions Using Cuisenaire® Rods (65-75 minutes)	

Introduction to Cuisenaire® Rods

1. Introduce the activities for this session by saying:
   - *Today we are going to continue to focus on fractions, but will use a new manipulative to illustrate fractional ideas.*
   - *It is important when developing understanding of fractions to be able to picture them in a variety of ways.*
   - *Last time we used pattern blocks to look at area. The manipulatives you will use today are called Cuisenaire® rods. The rods will enable you to consider fractions in terms of length.*

Cuisenaire® Rods

Chart It!

2. Allow participants to explore the rods and see that they come in ten colors with each color a different length.

3. Say:
   > With a partner, figure out one way that you might use Cuisenaire® rods to represent fractions.

They should notice that many of the rods fit together to make other rods.

Have participants share their ideas with the whole group.

Measuring Map Activity

1. Hand out one **Measuring Map** to each pair of participants.

2. Using a transparency of the **Measuring Map** and the overhead Cuisenaire® rods, demonstrate how the relative lengths of the rods build a "stair step" pattern.

By providing only one map per pair, you increase the opportunity for communication.

3. Participants will use Cuisenaire® rods to measure relative distances. Demonstrate 2 examples on the overhead:
   > If brown rods are placed along the entire route, then the Police Station is 1/3 of the way from my house to my school and the Burger Barn is 2/3 of the way from my house to my school. Write these fractions next to their place names on your list.

Remind participants that it is important to work with equal parts when determining fraction names.

Activities

Exploring Fractions Using Cuisenaire® Rods (continued)	Notes
4. Have participants use the rods as measuring tools to describe the relative distance of the rest of the locations and to find other fractional names for the same distances.	Having student share solutions anonymously is a way to encourage quieter participants to participate.
5. As groups work, pass around a **List of Locations** transparency to each group and ask each group to write some of the fractions they found.	They should notice that the list of fractions for a given place is a group of equivalent fractions. They might also notice patterns in the numerators and denominators of these fractions. **Chart It!**
6. As groups present, record the responses for each location on chart paper.	
7. Ask the participants what they notice about the chart.	

8. Hand out **Measuring Maps** to those who did not get them for use with the **Bringing Mathematics Home** activity then ask participants to set the maps aside.

note patterns in numerators and denominators of fractions

Chart It!

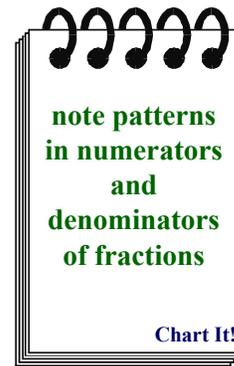**Defining fractional relationships between rods**

1. Tell participants that Cuisenaire® rods can also help illustrate fraction concepts when rods are compared to each other instead of to the length of the map.

2. Write the following on a blank transparency and ask them to work with a partner to fill in each blank. Demonstrate that red is 1/2 of purple. Have them find pairs that work for each situation.

It is common for some participants to describe collections of rod (such as 3 whites is 1/2 of dark green), but the task is to name the relationships using a single rod to fill in each blank. Remind them to look for <u>pairs</u> of rods that complete the relationship.

    A) _____ is 1/2 of _____.
    B) _____ is 1/3 of _____.
    C) _____ is 1/4 of _____.

3. Ask volunteers to state the pairs they found and to demonstrate their thinking using Cuisenaire® rods on the overhead projector.

4. Tell them that these are all considered to be unit fractions because the smaller length fits evenly into the larger length. They all have a numerator of one. Tell them that they are now going to look at example where this is not the case.

5. Ask them to take out a light green rod and a brown rod and complete this statement:

    Light green is _____ of brown.

This example is likely to perplex some participants since light green does not divide brown equally.

Activities

Exploring Fractions Using Cuisenaire® Rods (continued)	Notes
Allow time for participants to discover the fact that green does not fit evenly. 6. Ask participants why it is more difficult to name this relationship using a fraction. • Point out that it can be useful to use a rod that divides brown evenly as a measuring tool to find a new name for light green. • Ask them to find rods that fit both green and brown evenly. • Demonstrate that 8 white rods are the length of a brown rod, and that 3 white are the length of light green. So, light green is 3/8 of brown. 7. Pose another example to illustrate how to rename rods whose relationship is unclear: Purple is _____ of orange. 8. Point out that in this case there are two rods instead of one that can be used as measuring tools. Using white as the measuring tool produces the name 4/10, while using red as a measuring tool produces the name 2/5. Make sure participants see that this is another example of equivalent fraction names. 9. Have participants get with a partner and take out any two different rods. • Tell them they are to compare rods and describe what fraction the smaller rod is of the larger one. • Then have one partner choose another two rods and have the other partner give the fraction name, then switch roles. **Cuisenaire® Rod Relationships** 1. Hand out the sheet called **Cuisenaire® Rod Relationships**. 2. Instruct participants to complete this sheet with a partner or group members. 3. It is not necessary for each student to complete each problem. Encourage those who do not finish, to try the remaining problems at home with their children!	White rods can be used since they divide brown and light green evenly. Circulate to make sure participants are able to describe rod relationships by using smaller rods to divide both rods. The first three problems describe unit fraction relationships and should be easily solved. If participants have difficulty starting with the fourth problem, encourage a group or class discussion of possible strategies.

Activities

Exploring Fractions Using Cuisenaire® Rods (continued)	Notes

4. Ask some participants to demonstrate their solutions using the overhead Cuisenaire® rods.
 	
5. Pose a more difficult task.
Say:
  • Think about what happens when a larger rod is compared to a smaller rod.
  • Recall that yellow is 1/2 of orange.
  • Complete the statement about sizes:
 	
    Orange is _____ of yellow.
 	
Record the two relationships on **Chart It!** Use 2/1 for 2.
 	
  • Now try another one: Recall that purple is 2/5 orange. Complete this statement:
 	
    Orange is _____ (the size) of purple.
 	
Record the two relationships on **Chart It!**
 	
6. Ask participants to practice comparing rods by taking out any two rods, and describing the two relationships through fractions: the smaller to the larger, and the larger to the smaller
  • Again, have one partner choose two rods and have the other partner give the fraction names, then switch roles.
  • Discuss any observations participants make about the way the relationship changes when the colors are reversed. Introduce the term reciprocal, if participants do not use it. **Chart It!**
 	
7. Remind participants that the purpose in using manipulatives is to clarify important mathematical ideas. Ask them to share fraction ideas they have seen through the use of the Cuisenaire rods. **Chart It!**
	If time is short you may omit this final activity. Comparing a larger rod to a shorter one is difficult and requires participants to use mixed numbers or improper fractions.
	
	Using improper fraction names will help them to see the relationship here
	
	Record the two relationships
	
	Chart It!
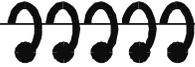	
	Reciprocal
	
	Chart It!
	
	Fraction Ideas with use of Cuisenaire® rods
	
	Chart It!

Activities

Closure (5-10 minutes)	Notes
1. This is the final session focused on fractions. Say: • *Today I want you to reflect on the experience of learning or re-learning fraction concepts using manipulatives.* • *Turn to your partner and discuss how your children might benefit by learning fractions through manipulatives and group work.* 2. Then ask each participant to share one interesting thing they heard their partner say.	Asking each person to share what a partner said provides validation to the quieter members of the group by making sure their ideas are heard and valued. To facilitate this sharing, you can return to the **Math Class Web** that was created in Session 1 and include additional ideas here.

Take Home Activities (5 minutes)	
1. There are two items for participants to take home: **Bringing Mathematics Home 4** and **Fraction Problems III**. 2. Encourage participants to try at least one of the **Bringing Mathematics Home** activities either with their children, their spouse or on their own. 3. Ask participants to complete the three problems on **Fraction Problems III** using pictures or manipulatives and be ready to share their solutions at the next class. These problems are applications of the kind of thinking they used to solve the Cuisenaire® rod problems in this session.	Participants will need to take a set of Cuisenaire® rods home to complete these take

Preparation for the Next Session (5 minutes)	
1. Collect name cards for use in the next sessions. 2. Fold or roll the **Fraction-Decimal-Percent Charts** in a way that preserves the items posted on them and bring them to the next class. 3. Save the **Chart It**! and bring it to the next class. If desired, you may have the log typed and distributed to participants at the next class.	