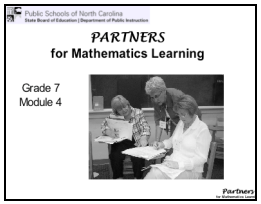
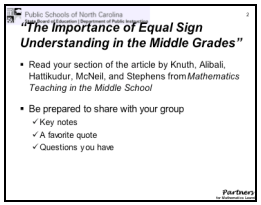
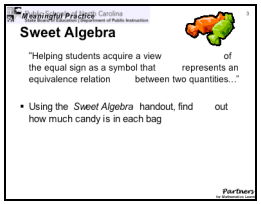
General Materials and Supplies:

Laptop, Projector, Power cord	Markers	Opaque paper bags
The Importance of Equal Sign Understanding in the Middle Grades Article	Chart Paper	Jolly Ranchers
Sweet Algebra Handout	*An Inequality Story* Handout	Graph Paper
Toothpicks	*An Inequality Story* Spec Sheet	Rulers
Sticks and No Stones Part I Handout	Square Tiles	*Taco Twister* Cards
Sticks and No Stones Part II Handout	Notebook Paper	

Slide	Tasks/Activity	Personal Notes
	(slide 1) **Module 4** Welcome back. This module focuses on algebra.	
	(slide 2) "**The Importance of Equal Sign Understanding in the Middle Grades"** Organize participants into groups of four. Each participant will read the introduction and one of the following sections in the article: • *Student's Equal Sign Understa*nding • *What Might Account for the Predominance of an Operational View of the Equal Sign?* • *Does it Really Matter if Students View the Equal Sign Relationally?* • *Helping Students to Develop a Relational View of the Equal Sign* Read your section of the article by Knuth, Alibali, Hattikudur, McNeil, and Stephens from *Mathematics Teaching in the Middle School.* ▪Be prepared to share with your group ✓Key Notes ✓A favorite quote ✓Questions you have Allow participants ample time to share with their group. Ask groups to pick a spokesperson from their group to share key points with the entire group.	



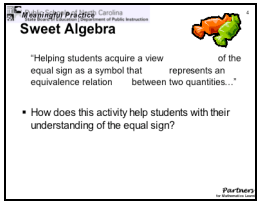
(slide 3) **Sweet Algebra**
"Helping students acquire a view of the equal sign as a symbol that represents an equivalence relation between two quantities…"

Ask participants to find and complete the *Sweet Algebra* handout (Module Four, Handout One)

Preparation ahead of time: In the classroom, teachers will want to fill each bag with the appropriate numbers of jolly ranchers.

Show participants the bags of candy. The leader (teacher) will have the bag marked with the *X*.
The remaining bags are labeled 1 to 10.
Participants complete the activity.

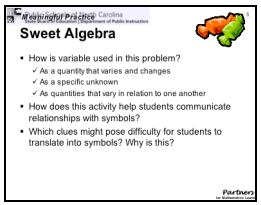
Using the *Sweet Algebra* handout, find out how much candy is in each bag.



(slide 4) **Sweet Algebra**
How does this activity help students with their understanding of the equal sign?

- Each of the clues represents equivalent relationships.
- Students create equations based on the clues.

Answers:
Teacher's Bag: **6**
Bag 1: **16** Bag 2: **18** Bag 3: **16** Bag 4: **19** Bag 5: **8** Bag 6: **3**
Bag 7: **19** Bag 8: **12** Bag 9: **20** Bag 10: **14**



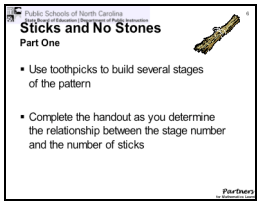
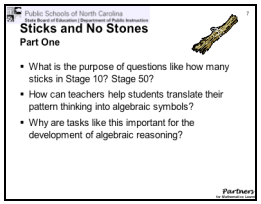
(slide 5) **Sweet Algebra**
How is variable used in this problem?

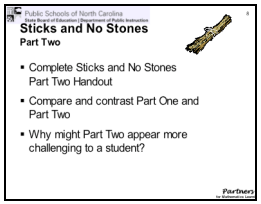
- ✓ As a quantity that varies and changes
- ✓ **As a specific unknown**
- ✓ As quantities that vary in relation to one another

In this activity, the variable represents the number of jolly ranchers in the leader's/teacher's bag.

How does this activity help students communicate relationships with symbols?

- Students can relate to the statements from this activity; activity is non-threatening.

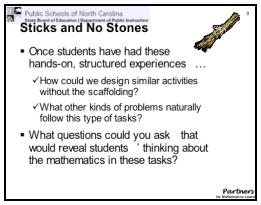
	• Students translate from words to symbols. *Which clues might pose difficulty for students to translate into symbols? Why is this?* • Clues that involve subtraction; sometimes students reverse the subtraction relationships. • Clues that involve fractions; students have difficulty understanding operations with fractions.	
	(slide 6) **Sticks and No Stones Part One** Ask participants to find the *Sticks and No Stones Part One* Handout (Module Four, Handout Two). Provide participants with toothpicks. Encourage them to use toothpicks to build several stages of the pattern. Ask participants to complete the handout as they determine the relationship between the stage number and the number of sticks.	
	(slide 7) **Sticks and No Stones Part One** *What is the purpose of questions like how many sticks in Stage 10? Stage 50?* • Want students to move from the concrete representation to the abstract and form generalizations. *How can teachers help students translate their pattern thinking into algebraic symbols?* • Provide students with manipulatives to create the models. • Encourage students to build the models. • Provide students with many opportunities to see patterns. • Encourage students to look at patterns geometrically as well as algebraically. • Encourage students to look at the pattern in the table and see if they can recognize the same pattern in the physical model. *Why are tasks like this important for the development of algebraic reasoning?* • Pattern recognition leads to the understanding of linear and non-linear relationships. • Rules that determine what comes next are examples of functions. • Tasks like this provide students with multiple representations of the same pattern.	



(slide 8) **Sticks and No Stones Part Two**
Ask participants to find and complete *Sticks and No Stones Part Two* Handout (Module Four, Handout Three).

Have participants compare and contrast Part One and Part Two.

Why might Part Two appear more challenging to a student?
- Students are not adding the same "design" each time



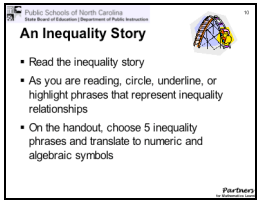
(slide 9) **Sticks and No Stones**
Ask participants to offer suggestions to the following.
Once students have had these structured experiences
- *How could we design similar activities without the scaffolding (asking for pattern extensions, setting up the chart, creating the graph, and asking for a function)?*

For example, we could give instances of a growing pattern and ask students to organize the data without providing a table. Or we could give instances of a growing pattern and just ask for a function.

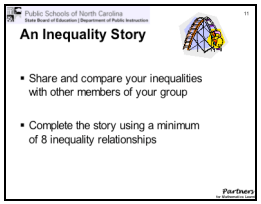
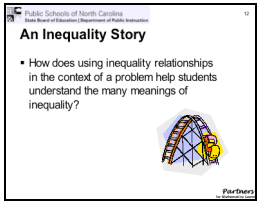
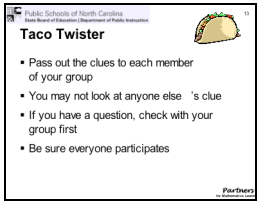
- *What other types of problems naturally follow these?*

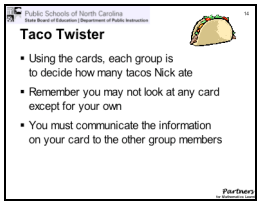
Other problems might include patterns involving numbers that are not whole numbers (ie, compare cell phone minute plans), more complicated nonlinear growth patterns, or giving students a rule or function and have them create the growing pattern with manipulatives.

What questions could you ask that would reveal students' thinking about the mathematics in these tasks?
How did you determine your rule?
Will you ever get a different output value with your rule (assuming the same input)?



(slide 10) **An Inequality Story**
Ask participants to read the *Inequality Story* (Module Four, Handout Four).
As they are reading, remind them to circle, underline, or highlight phrases that represent inequality relationships.
On the handout, choose 5 inequality phrases and translate to numeric and algebraic symbols.

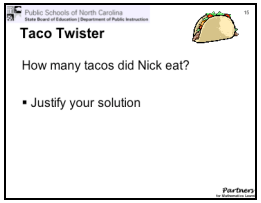
	(slide 11) **An Inequality Story** Ask participants to share and compare their inequalities with other members of their group. Have participants share their inequalities with the whole group. Make a list of the inequalities on chart paper. Ask participants to complete the story using a minimum of 8 inequality relationships. Provide participants with a spec sheet of amusement park rides (Module Four, Handout Four). In the classroom teachers will want to give students the opportunity to visit amusement park web sites for specs of different rides or print out spec sheets and ride requirements for students to use in class.	
	(slide 12) **An Inequality Story** *How does using inequality relationships in the context of a problem help students understand the many meanings of inequality?* • Students can relate to the context and therefore think about/visualize what the words mean.	
	(slide 13) **Taco Twister** Provide each group of participants with an envelope of clues for the Taco Twister task (Module Four, Handout Five). Explain the rules for the cooperative group activity. • *Each participant gets a clue card.* • *Each participant reads their clue card to the group.* • *Participants may not look at anyone else's clue nor show their clue to anyone else.* If participants have a question, they are to check with their group first. *Note to facilitators*: Cards 1 through 4 are necessary for the activity; cards 5 and 6 are optional but helpful.	



(slide 14) **Taco Twister**

Have square tiles available for groups that may choose to use them.

- *Using the cards, each group is to decide how many tacos Nick ate.*
- *Remember you may not look at any card except for your own.*
- *You must communicate the information on your card to the other group members.*



(slide 15) **Taco Twister**

How many tacos did Nick eat? Justify your solution.

Allow groups ample time to share their solutions with the whole group. Remember that an exact answer for this problem cannot be determined.

Nick had at least two tacos, but no more than 6 tacos.

$H = C + 5$ $C = H - 5$

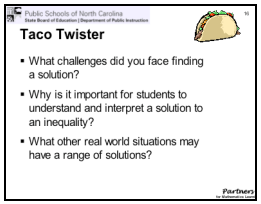
$C = 0.5L$ $2C = L$

$N = L - 2$ $L = N + 2$

$H > L$
$C + 5 > 2C$
$5 > C$

Cody ate less than 5 tacos.
Hector ate less than 10 tacos, but more than 5 tacos. ($H < C + 5$)
Nick ate less than 8 tacos. ($N < 2C - 2$)
Lauren ate less than 10 tacos. ($L < 2C$)

Hector	Cody	Nick	Lauren	Total Tacos Ate
8	3	4	6	21
6	1	0	2	9
9	4	6	8	27
7	2	2	4	15



(slide 16) **Taco Twister**

What challenges did you face finding a solution?

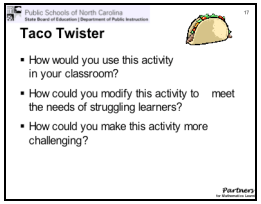
- Organizing information
- Not one single solution

Why is it important for students to understand and interpret the solution to an inequality?

- Inequalities have more than one solution
- Understanding phrases such as *no more than, maximum, at most, etc.*

What other real-world situations may have a range of solutions?

- Rocket may enter an atmosphere at a range of angles
- Amusement park ride limitations
- After an oil change, the oil is good for so many miles best on the type of driving
- Answers will vary



(slide 17) **Taco Twister**

How would you use this activity in your classroom?

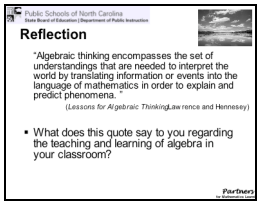
- Assessment of inequality understanding
- Cooperative grouping
- To model more than one solution

How could you modify this activity to meet the needs of struggling learners?

- Give groups clues 5 and 6.
- Add additional clues such as: There were at least 10 total tacos eaten, and no more than 30 total tacos eaten. Everyone had at least one taco. No two people ate the same amount of tacos.

How could you make this activity more challenging?

- Have students create a similar set of task cards.

	(slide 18) **Reflection** "Algebraic thinking encompasses the set of understandings that are needed to interpret the world by translating information or events into the language of mathematics in order to explain and predict phenomena." (*Lessons for Algebraic Thinking*, Lawrence and Hennessy) *What does this quote say to you regarding the teaching and learning of algebra in your classroom?* Have participants write their responses to this quote individually. Ask for individuals to share as time permits.	
	(slides 19-22) **Credits for project and closing slides**	