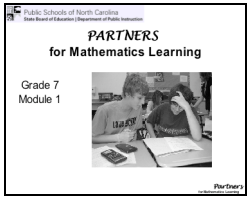
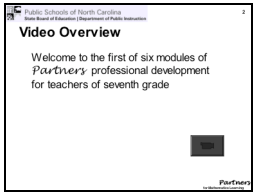
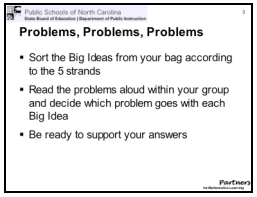
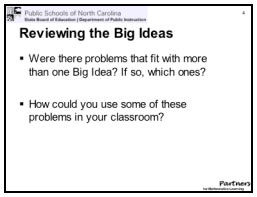
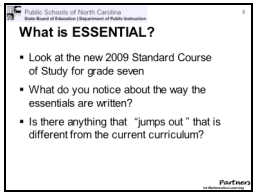
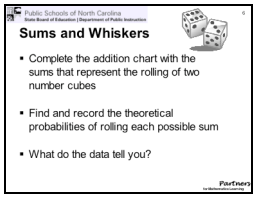
General Materials and Supplies:

Laptop, Projector, Power Cord	Calculators	2 colors of sticky notes	Essential Standards Handout
Sets of Dice	*cm* grid paper	*X Marks the Spot* Handout	Rulers
Sums and Whiskers Handout	Stopwatch (clock with second hand)	Graph Paper	
Problems, Problems, Problems Card Sets	*Big Idea* Cards	Big Ideas Handout	

Slide	Tasks/Activity	Personal Notes
	(slide 1) **Module One: This module focuses on problem solving and data analysis.** *Introductions* • Establish ground rules • Take care of any paperwork	
	(slide 2) **Video** Welcome to Partners for Mathematics Learning Professional development. This module, like others that will follow, relates the big ideas of K-8 mathematics to North Carolina's new 2009 Essential Standards for your grade level. Our goal is to assist you in helping your students develop a deep understanding of the mathematics they need to learn. These modules include strategies for developing problem solving and mathematical reasoning, discussions of important content, and suggestions for assessing student thinking. As we work together to increase student achievement in mathematics, we recognize the numerous challenges that teachers face. It is our hope that within this professional development you will find support for helping all students become fluent with mathematical concepts and procedures. Thank you for being part of North Carolina's continued progress toward mathematical excellence.	

	(slide 3) **Problems, Problems, Problems** Participants will work in table groups to complete this activity. • Give each group a set of Problem cards and a set of Big Idea cards (Module One, Handout One) • Ask groups to sort the Big Idea cards according to the 5 strands (Number and Operations, Measurement, Geometry, Data Analysis and Probability, and Algebra) • Ask the groups to choose a reader. The reader will read the problem and the group will decide which Big Idea matches the problem.	
	(slide 4) **Reviewing the Big Ideas** A whole group discussion should follow focusing on the following questions: *Were there problems that fit with more than one Big Idea? If so, which ones?* • These answers will vary. • Be careful not to discredit any group's matches • Encourage participants to justify their findings. *How could you use some of these problems in your classroom?* • Warm-up problems • Assessments • Have students write multiple choice answers for these problems • Think, Pair, Share • Journal entries As this discussion wraps-up hand out the NC Essential Standards for grade seven.	
	(slide 5) **What is Essential?** Introducing the new curriculum… • *Look at the new standards for grade 7* • *What do you notice about the way they are written?* • *Is there anything that "jumps out" as very different from the current curriculum?* Note to participants that this is a first-glance look; there will be time later for a closer look, so just consider the structure and noticeable changes.	



(slide 6) **Sums and Whiskers**

Ask participants to find the *Sums and Whiskers* handout (Module One, Handout Two).

- Complete the addition chart with the sums that represent the rolling of two number cubes.
- Find and record the theoretical probabilities of rolling each possible sum.

Sum of 1: 0 Sum of 2: $\frac{1}{36} \approx 3\%$ Sum of 3: $\frac{2}{36} \approx 6\%$

Sum of 4: $\frac{3}{36} \approx 8\%$ Sum of 5: $\frac{4}{36} \approx 11\%$ Sum of 6: $\frac{5}{36} \approx 14\%$

Sum of 7: $\frac{6}{36} \approx 17\%$ Sum of 8: $\frac{5}{36} \approx 14\%$ Sum of 9: $\frac{4}{36} \approx 11\%$

Sum of 10: $\frac{3}{36} \approx 8\%$ Sum of 11: $\frac{2}{36} \approx 6\%$ Sum of 12: $\frac{1}{36} \approx 3\%$

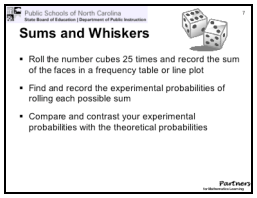
Note: A percent is fundamentally different than a fraction or decimal. Percents are not considered values, but operators. We look at percent in the context of "percent of some value". The percentage above refers to "the percent of the number of rolls".
For example: 11% of the time that we roll two dice, we should get a sum of five.

What do the data tell you? Ask participants to predict what the mean, median, mode, and range of the experimental results based on the theoretical probabilities.

- You will never get a sum of one.
- You should roll a sum of 7 the most.
- You have the same chance of rolling a sum of 2 as a sum of 12.

Extension Questions:

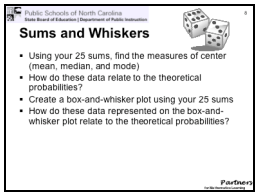
1. *There are 7 out of 36 ways to roll a sum of 7; if you roll the pair of dice 100 times, about how many times would you expect to get a sum of 7?* **About 21 times**
2. *There is 1 out of 36 ways to roll a sum of 12; if you roll the pair of dice 144 times, how many times would expect to roll a pair of sixes?* **4 times**



(slide 7) **Sums and Whiskers**

Provide pairs of participants with two number cubes.

- Have participants roll the number cubes 25 times and record the sum of the faces in a frequency table or line plot on their handout. Allow participants to choose which way they want to display their data.
- Find and record the experimental probabilities of rolling each possible sum.
- Compare and contrast your experimental probabilities with the theoretical probabilities. Would these probabilities be closer if you rolled 100 times? Or 500 times?



(slide 8) **Sums and Whiskers**

Have participants find the measures of center (mean, median, and mode) for their 25 sums (experimental data).

How do these data relate to the theoretical probabilities?

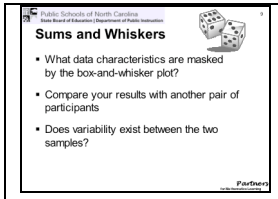
- Answers will vary but participants will see some similarities in their results.
- My range of sums is from 2 to 12.
- I rolled a sum of 7 the most. My mode matches the theoretical probability that I have the best chance of rolling a sum of 7.

Have participants create a box-and-whisker plot using their 25 sums. You may want to verify that all participants know how to create a box-and-whisker plot. One-on-one instruction may be needed for some.

How do these data represented on the box-and-whisker plot relate to the theoretical probabilities?

- Answers will vary but participants will see some similarities in their results.
- Discuss with participants how the median relates to the addition table.

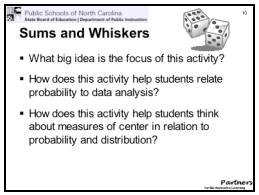
(slide 9) **Sums and Whiskers**



What data characteristics are masked by the box-and-whisker plot?

- Mean
- Mode
- Example: the middle 50% could range from 6 to 8, but you might have only rolled sums of 7

Compare your results with another pair of participants. Does variability exist between the two samples?



(slide 10) **Sums and Whiskers**

What big idea is the focus of this activity?

Multiple counting strategies and sample space representations are used to determine theoretical probabilities; experimental and theoretical probabilities can be computed and compared
Collection, analysis, and interpretation of univariate data are used to make decisions and solve problems

How does this activity help students relate probability to data analysis?

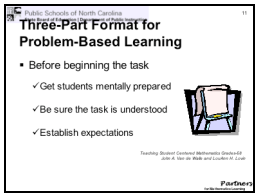
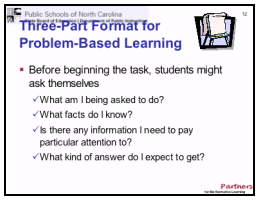
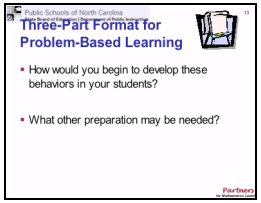
- Finding probabilities is a collection of data
- Using frequency tables to display experimental probabilities is one way to analyze and interpret the data.
- Answers will vary.

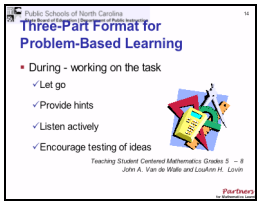
How does this activity help students think about measures of center in relation to probability and distribution?

- The result with the highest chance should be close/equivalent to the mode, median, and mean.
- This is an activity where the mean, median, and mode should be equal or close to equal.
- Finding experimental probability may or may not lead to the expected results.
- Sample space for finding the sum of rolling two number cubes is {2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12} and the data ranges and is distributed from 2 to 12.

Extension of Activity:

Teachers may want students to graph their data sets on a graphing calculator.
Collect all the data from each pair of students in an Excel spreadsheet or in the graphing

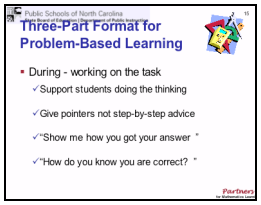
	calculator and display a box-and-whisker plot for the entire class data.	
	(slide 11) **Three-Part Format for Problem-Based Learning** Have a volunteer read the bullets on this and the following slides. Research from *Teaching Student Centered Mathematics Grades 5 – 8* *John A. Van de Walle and LouAnn H. Lovin* <u>Before beginning the task</u> • Get students mentally prepared – begin with a simple version of the task, brainstorm solutions, use mental math to estimate answers • Be sure the task is understood – help the students clarify what the problem is asking, have students restate the problem in their own words, review vocabulary • Establish expectations – "Every task should require more of students than simply the answer." – make clear to students when they will be required to explain, write, or discuss	
	(slide 12) **Three-Part Format for Problem-Based Learning** <u>Before beginning the task, students might ask themselves</u> • What am I being asked to do? • What facts do I know? • Is there any information I need to pay particular attention to? • What kind of answer do I expect to get?	
	(slide 13) **Three-Part Format for Problem-Based Learning** Ask participants to discuss their responses to the following in partners and then share with the group. *How would you begin to develop these behaviors in your students?* Teachers could model that behavior Teachers could call on students who are using these behaviors to share with others *What other preparation may be needed?* Answers will vary.	



(slide 14) **Three-Part Format for Problem-Based Learning**

During – working on the task

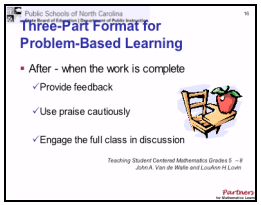
- Let go – give students a chance to work without guidance
- Provide hints – not solutions
- Listen actively – "Tell me what you are doing?" – "Show me how you got that answer." – "Explain."
- Encourage testing of ideas – "Why do you think that you might be right?" – "How can you check your solution?"



(slide 15) **Three-Part Format for Problem-Based Learning**

During – working on the task

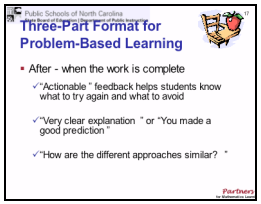
- Support students doing the thinking
- Give pointers not step-by-step advice
- Show me how you got that answer
- How do you know that you are correct



(slide 16) **Three-Part Format for Problem-Based Learning**

After – when the work is complete

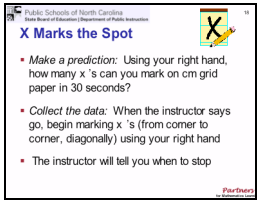
- Provide feedback – what is correct and what needs to be revisited
- Use praise cautiously – praise for one student may be negative feedback to another
- Engage the full class in discussion – list answers from all of the groups, have one or more groups explain their solutions, allow students the opportunity to defend their answers, encourage students to ask other students questions



(slide 17) **Three-Part Format for Problem-Based Learning**

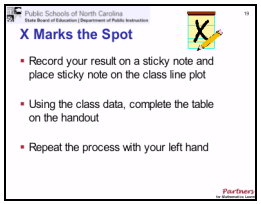
After – when the work is complete

- "Actionable" feedback helps students know what to try again and what to avoid
- "Very clear explanation" or "You made a good prediction"
- "How are the different approaches similar?"



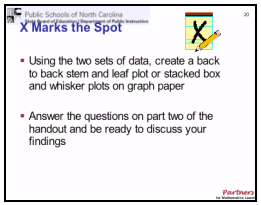
(slide 18) **X Marks the Spot**
Give each participant two sheets of blank *cm* grid paper and have them get out the *X Marks the Spot* handout.

- Have participants make a prediction: Using your right hand, how many x's can you mark on cm grid paper in 30 seconds? Record prediction on handout.
- Collect the data. When the instructor says go, begin marking x's (from corner to corner, diagonally) using your right hand. The instructor will tell you when to stop. Time participants for 30 seconds.

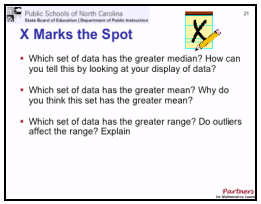


(slide 19) **X Marks the Spot**

- Have participants record their results (number of x's) on a sticky note.
- Using their sticky notes, have participants create a line plot on the board or wall.
- Using the class data, complete the table on the handout.
- Participants will repeat the process with their left hand.



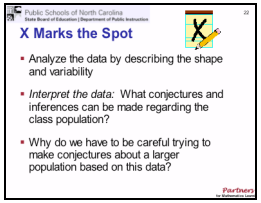
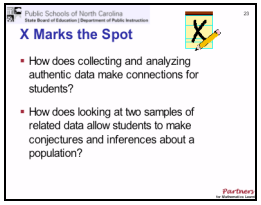
(slide 20) **X Marks the Spot**
Have participants create a back to back stem and leaf plot or stacked (one below the other using the same number line) box and whisker plots. (You might want to ask pairs to create a specific graph to ensure that both graphs are represented.)
Have participants answer the questions on part two of the handout.

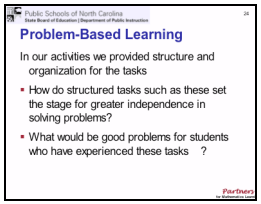
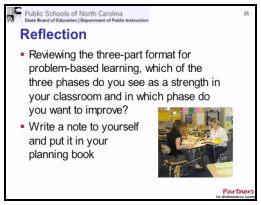


(slide 21) **X Marks the Spot**
Which set of data has the greater median? How can you tell this by looking at your display of data?
Answers will vary based on data.

Which set of data has the greatest mean? Why do you think this set has the greater mean?
Assuming that there are more right-handed participants, the mean for the right-handed data should be higher based on the fact that right-handed people write with their right hand.

<u>Fun Facts</u>: 90% of the world's adult population is right-handed
It was not until the 20th century, that the number of naturally left-handed people stayed left-

	handed. Up until this time, people were influenced to change to right-handedness. Eight of 44 Presidents have been left-handed, including our current president. *Which set of data has the greater range? Do outliers affect the range? Explain*. Answers will vary based on data.	
	(slide 22) **X Marks the Spot** Analyze the data by describing the shape and variability. Interpret the data. *What conjectures and inferences can be made regarding the class population?* • Encourage participants to think about the number of right-handed people and the number of left-handed people. *Why do we have to be careful trying to make conjectures about a larger population based on this data?* • We sampled a group of teachers who were predominantly female. • We sampled only 7th graders. • Some adults might write faster; some children may write slower.	
	(slide 23) **X Marks the Spot** *How does collecting and analyzing authentic data make connections for students?* • The data becomes real to them because they are a part of the data. • The data is more meaningful and purposeful. *How does looking at two samples of related data allow students to make conjectures and inferences about a population?* • Students can compare and contrast the two data sets. • Students can use their data analysis to identify characteristics of a population.	

	(slide 24) **Problem-Based Learning** Have participants discuss these questions at their tables. Ask for a volunteer from each group to share their responses. *In our activities we provided structure and organization for the tasks. How do structured tasks such as these, set the stage for greater independence in solving problems?* Structured activities are useful for developing students' skills in organizing data and developing student understanding of concepts. *What would be good problems for students who have experienced these tasks?* Similar problems in which students must make their own decisions about what data to collect and how to collect and organize the data would be appropriate.	
	(slide 25) **Reflection** Ask participants to write a note to themselves in response to the following question, that they will put in the planning book. *Reviewing the three-part format for problem-based learning, which of the three phases do you see as a strength in your classroom and in which phase do you want to improve? Explain.*	
	(slides 26-29) **Credits for project and closing slides**	