Research Lesson Proposal for Kindergarten - Composing & Decomposing Single Digit Numbers

For the lesson on May 4, 2016
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1. **Title of the Lesson:**

Japan Math K- Unit 4: Two Numbers Together, Lesson 3: Making 7

2. **Brief description of the lesson**

Students will learn how single digit numbers are composed or decomposed by manipulating semi-concrete objects, such as counters and counting blocks. The major objective at this stage of learning is that students are able to view a number in multiple ways. (pg118)

3. **Research Theme**

Our research theme is for students to be able to clearly communicate their ideas and strategies, and be able to justify and/or critique each others' reasoning. This skill will help them make sense of and apply strategies that they have learned from their teacher and their peers. This relates to standard for mathematical practice 3, construct viable arguments and critique the reasoning of others. SMP3 states that, "Mathematically proficient students...justify their conclusions, communicate them to others, and respond to the arguments of others...Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments."

4. **Goals of the Unit**

- In this unit, students expand their view of numbers. They create numbers by combining numbers and decomposing numbers into two different constituent numbers (subsets). Students gain a broader perspective on numbers, seeing them as composed of several different combinations of numbers. The lessons in this unit will enhance students' number sense as they take multiple perspectives on numbers, becoming curious about decomposition and seeing its usefulness. (p. 109)
- Students will further extend the idea of seeing a number from multiple perspectives (to see the structure of these numbers, for example 2 and 5 is 7). (p. 109)
    - Students will be able to think about and see a number as made up of more than one combination of constituent numbers.
    - Students will be able to represent numbers from 1 to 10 in words and using semi-concrete representations (counting blocks, counters, 10-frame dot cards, etc.)

    - Students will be able to compose a number from constituent numbers and decompose a number into constituent numbers.
    - Students will be able to understand and represent the structure of a number.
- Finally, students how to represent the decomposition of numbers using equations (math sentences). (p. 109)
    - Students represent the decompostion of 8 as 8 = 3 + 5 and read it aloud as 8 is 3 and 5.
- Communicate their reasoning to demonstrate understanding of unit and lesson goals.
    - "I found the answer by…"
    - using manipulatives, illustrations, fingers and number chart to show thinking
    - "First I did this, then this"
- Begin to ask useful questions to clarify and improve others' arguments
    - How did you find your answer?
    - Why did you do that first?
    - How many did you have to add to make ten?
    - nonverbal hand signals (agree, disagree, add more)

5. Goals of the Lesson:

a. Students will be able to tell how many more are needed to make 7 given a number between 1-6.
b. Students will be able to tell the fact families for 7.
c. Students will be able to discuss with a partner how to find the missing number to make 7.
d. Students will be able to explain how they found the missing number to make 7.

6. Relationship of the Unit to the Standards

<u>Kindergarten Learning Standards</u>

This unit address the following kindergarten standards:

K.OA.3: Decompose numbers less than or equal to 10 into pairs in more than one way (5=2+3 and 5=4+1).

K.OA.4: For any number 1 to 9, find the number that makes 10 when added to the given number.

K.NBT.1: Compose and decompose numbers from 11 to 19 into ten ones and some further ones (18=10+8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.

<u>Related First Grade Learning Standards</u>

1.OA.2: Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20...

1.OA.6: Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., 8+6=8+2+4=10+4=14)...

1.OA.1: Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

Background and Rationale

Our research theme is for students to be able to clearly communicate their ideas and strategies, and to be able to justify their reasoning. Students, particularly in the primary grades, have a difficult time communicating their ideas clearly and precisely. As we found in the previous lesson study cycle, the language that students see early on is quite difficult. The deep extended experiences that students have with addition in kindergarten should give students the content knowledge and the confidence to clearly communicate their ideas and strategies.

In a previous unit (unit 1), students began to think about the composition and decomposition of numbers and quantities. For instance, the picture on page 28 shows 6 dogs that can be viewed in several different ways by students. There can be 4 small dogs and two big dogs that make 6 altogether. Or students may see 6 as a whole group that is decomposable into a group of 4 small dogs and a group of 2 big dogs. Focusing on the color of the dogs, students may see 3 white dogs and 3 black dogs with 6 dogs altogether. Or students may see the whole group of 6 dogs and separate them into 3 white dogs and 3 black dogs (decomposing 6 into 3 and 3). Students have already considered a number from multiple perspectives. In unit 1, however, the focus was on noticing numbers in different combinations or subsets. The current unit focuses on noticing different combinations for composition and decomposition of the total.

In this unit, students further extend the idea of seeing a number from multiple perspectives, simultaneously understanding that “two and five is seven” (composition) and that seven is two and 5 (decomposition). These perspectives serve as a foundation for addition and subtraction. Understanding and learning the combinations that make 10 is critical for deep understanding and facility with the base ten system. That is, the making tens strategy is a prerequisite for fluency with addition and subtraction calculations involving regrouping.

Additionally, when numbers are represented in a regular, orderly way, students can grasp the structure of numbers. For a given number or total, when one constituent number is defined, the other constituent number is also defined; as one constituent number increases, the other decreases. The action of compensation is an algebraic view.

Finally, students learn how to represent the decomposition of numbers using equations (math sentences). For example, in this unit, students represent the decomposition of 8 as 8=3+5 and read it as 8 is 3 and 5. However, formal writing and reading of math sentences is introduced in unit 5.

The curriculum explains that when the textbook asks, "Five is made up of what numbers?" it prompts a decomposition view. The teacher should consider asking, "What numbers do we use to make five?" to prompt a composition view. Decomposition and composition are opposites and their doing-undoing relationship means that asking students to engage in both ways of thinking will ultimately enhance their understanding.

We will focus our research lesson and data collection on how clearly students communicate their ideas. We also want to explore the quality of the interactions between students.

7. Research and Kyozaikenkyu

Our topic for this unit is composing and decomposing single digit numbers. In this unit, students expand their view of numbers. They create numbers by combining and decomposing numbers into two different constituent numbers. Students gain a broader perspective on numbers, seeing them as composed of several different combinations of numbers. This unit will enhance students' number sense as they take multiple perspectives on numbers, becoming curious about decomposition and seeing its usefulness.

We explored the following articles to help us navigate how to set up our research lesson in order to best meet the goals of the unit.

Raise the Bar on Problem Solving (Lisa Englard)

This article introduced the Model Method as a means of solving word problems. The Model Method is a pictorial method of showing the relationships of values in word problems. When students use this method, they are clearly able to show the information in the problem and their thinking of how to solve it. Often students resort to looking for keywords in word problems and use those keywords as shortcuts for creating equations. However this method for solving problems often leads students to wrong answers and incorrect understandings of the given scenario. Using the Model Method not only assists students in organizing the information from the problem but forces them to think more deeply about how the numbers in the given problem are interacting. Because of this, the Model Method is extremely helpful in solving multi-step problems by providing a clear, visual representation of the process involved.

As related to our research theme: Students who use this method would hopefully be more adept at discussing a word problem with their peers since they would have already shown all of their thinking and reasoning on paper. The Model Method would also act as a tool

for explaining how they solved the problem. This would also provide opportunities for students to explore and show varying ways of solving word problems.

Three Pillars of First Grade Mathematics (Roger Howe)

Addition and subtraction problems come in three categories: change, comparison, and part/whole. Each of these types can be represented with both addition and subtraction. Students need to be able to interpret different types of word problems with unknowns in different positions to manipulate and solve equations. A subtraction equation can be changed to an unknown addend equation, and vice-versa. Students learn by seeing, especially when learning abstract concepts. Students need to be able to provide a variety of examples to explain their understanding of concepts so it is important to present various situations where students can explore, practice and improve their understanding of arithmetic.

Students need to be able to use the making tens method for addition and subtraction (ex: $6 + 7 = 6 + (4 + 3) = (6 + 4) + 3 = 10 + 3 = 13$). Foundations include composing and decomposing numbers within 10, especially making and decomposing tens. Students should be able to make and unmake teen numbers using tens and a certain number of ones. They should also be able to equate different decompositions of the same number (e.g., $4 + 1 = 3 + 2 = 2 + 3 = 1 + 4 = 5$).

Recent Trends in Japanese Mathematics Textbooks for Elementary Grades: Supporting Teachers to Teach Mathematics through Problem Solving (Akihiko Takahashi)

This article places great emphasis on problem solving in Japanese mathematics education and its impacts. Problem solving is not viewed as an end-of-the-chapter activity that is solely focused on developing problem solving skills and strategies. Instead, the approach has been used throughout the curriculum as a process for learning mathematics. Japanese problem solving lessons usually do not end even after each student finds a solution to the problem. According to this article, the heart of the lesson begins after the students come up with a solution.

8. Unit Plan

Lesson	Learning goal and tasks (pg.)
1	Composing and decomposing 5 (48-49)
2	Composing and decomposing 6 (50)
3	Composing and decomposing 7 (51)
4	Composing and decomposing 8 (52) Learning about how to read and write equations (math sentences)
5	Composing and decomposing 9 (53) Recording the decomposition of 9 using equations.
6	Composing and decomposing 10 (54) Recording the decomposition of 10 using equations.
7	Composing and decomposing 10 (55)

	Recording the decomposition of 10 using equations.
8	Composing and decomposing 10, Let's Make Ten (56)
9	Composing and decomposing 10, Let's Try (57)
10	Composing and decomposing numbers up to and including 10. Recording the decomposition of numbers up to and including 10.

9. Design of the Unit and Lesson

The research theme for the unit and lesson comes from Common Core State Standard Mathematical Practice 3: Construct viable arguments and critique the reasoning of others.

Prerequisite learning:

- Using manipulatives
- Communicate their reasoning and explain different addition strategies
- Use a math journal to communicate their thinking

The research lesson is lesson #3. This lesson was chosen because it will provide students with opportunities for discussion and allow us to observe their conversations during the dice game. One student will roll the die and and look at the number, then ask the other student how many more are needed to make 7. The other student will answer using counters or other manipulatives.
Students will compose and decompose numbers by manipulating semi-concrete objects, such as counters and counting blocks. Students must be able to view a number in multiple ways, and student language should reflect an understanding of both composition and decomposition (7 is made of 4 and 3; 3 and 4 make 7).

10. Lesson Plan

Steps, Learning Activities Teacher's Questions and Expected Student Reactions	**Teacher Support**	**Points of Evaluation**
Goal/outcome of the lesson: Students will be able to tell how many more are needed to make 7 given a number between 1-6. Students will be able to discuss with a partner how to find the missing number to make 7. Students will be able to explain how they found the missing number to make 7.		
1. How will we pose the problem / What's the hook? (5 minutes) We have been practicing making numbers. Yesterday we found all the ways to make 6. Tell your buddy one way to make 6, and tell your buddy how you		*Did students remember a way to make the number six?* *Did students remember and articulate how they made*

know that. "I know that __ and __ makes 6 because…" ~~How many ways did we find to make 6 (for engagement)?~~ Review poster.		*the number six?*
2. What is the structure for student problem solving (Independent? Partner work? Turn and talk, etc?) / tasks (10 minutes) Today I want you to work with a partner to make 7. Show me seven fingers. Put the number 7 on your hand. . *Here are some tools that we have used to help us practice making numbers. Review the board: We have used the counters, the ten frame, the flowers, and the dice,* *And here are some strategies you have been using to find how many you need to make the number. Review the board: we made groups, we counted up, we covered and counted the ten frame.* *And remember we have to be talking about math. Talking helps us learn. Here are some questions to help us talk about math: What number do you have? What other number do you need to make 7? How did we make 7? How do you know?* With your buddy, write down all the ways you find to make 7. When we're done, we will write down all the ways we found to make 7. *Don't forget to talk about math. And today, you get to choose your tools to help you!* *Stand up, find your buddy, and we are going to walk in line to get our tools.*	Student pairs will have *a choice of* 1 die, a set of seven counters, and *a set of seven flowers.* *Every table will have pencils, work sheets,* ten-frames of 7, *and a number strip*.	Seating chart of groupings. Teacher will walk around, noting strategies that students are using, to be presented in the discussion portion of the lesson.

3. Anticipated Student Responses (correct and incorrect)
- Students missing objective of game
  - Students wanting to roll the biggest number on the die, missing the objective of the game.
  - Student trying to roll the same number as their partner.
- Students not knowing how to count on
	Teachers (2) will be walking around to table groups, correcting misunderstandings, and redirecting behaviors.	*Are students using tools and strategies to get results? Are students getting the correct results and recording them appropriately?*

- Students miscounting *-Students may not have conversation. They may just get results recorded.* *-Students might ask the wrong question in relation to the tools they're using.* *-Students making the wrong number.*		*If they find a pair of numbers twice*, will they use that as another one of their pairs to make 7?
4. How do we use student responses strategically in a discussion to help move student understanding forward? (10 minutes) Come together as a class. *Students will turn and talk with a buddy about the ways they found to make 7 and how.* Share student responses; Students present their strategy (chosen by teacher during previous part of lesson; *we'd like to choose a student who uses an interesting strategy or a student or makes a common error*). Use counters on the board to prove/disprove student responses. (Teacher can highlight different ways that students found the ways to make 7; counting on fingers, using counters, using the ten-frame, etc.) Create an anchor chart of all the ways to make 7 *(if time allows, otherwise anchor chart will be made the following lesson)*. ~~Count how many ways to make 7 (just for engagement).~~	*Teacher will guide discussion and push students to show their thinking.*	- Did students count correctly? - *Will students be able to articulate how they found a way to make 7?*
5. What is the plan for the board as discussion progresses? ~~Begin with nothing~~ ***Changing Board:*** Show anchor chart of number 6 fact families Write the number 7 (digit, ten-frame) Student examples with manipulatives Anchor chart of number 7 ***Anchor Board:*** *Pictures of tools* *Pictures of strategies* *Example questions*		
6. How will students synthesize their learning? (e.g., summary, reflection statement, practice problems, evaluation question) Summing up (10 minutes) *See #4*		

Is the order with which they write the numbers important?

11. Evaluation

This section often includes questions that the planning team hopes to explore through this lesson and the post-lesson discussion.

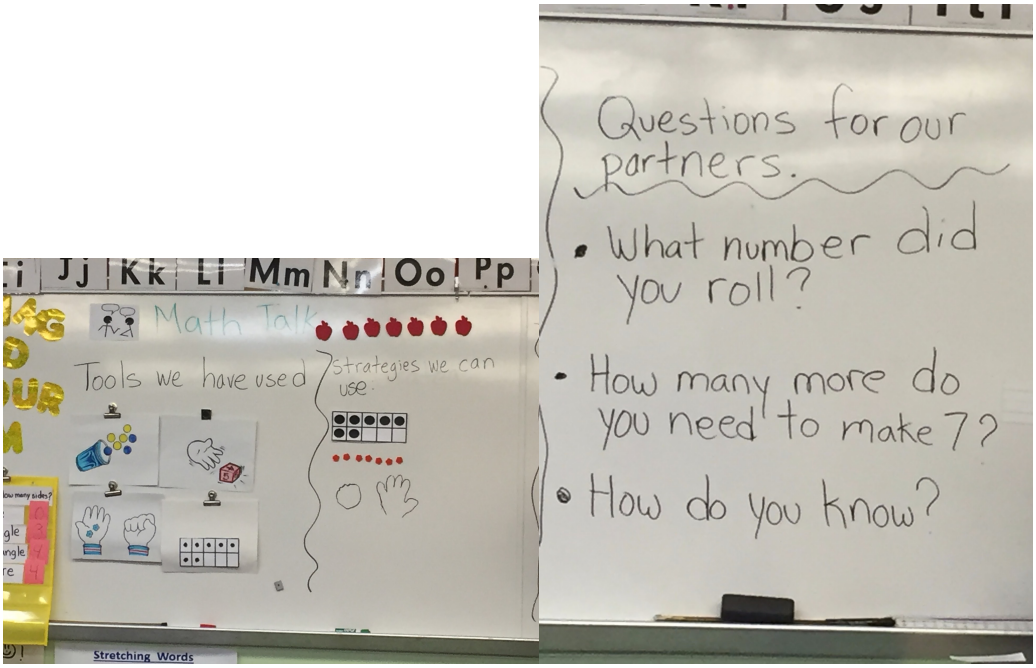
Related to our research theme:

1. How did the structure of the lesson affect the quantity and quality of student discourse?
2. How did our planned questions and/or the teacher's questions affect student communication during the comparison and discussion section of the lesson?

Related to the goals of the lesson:

1. What do students say/do to reveal their understanding that a number can be viewed in multiple ways?

12. Board Plan



13. Reflection

After the research lesson, the team should append to the original lesson plan a summary of major points from the discussion. This may be a few paragraphs in length and makes the final document ***much more valuable*** *to an outside audience.*