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Date of lesson: September 8th, 2011

Time and location: 8:00am at Mintie White Elementary School

Revised: October 6, 2011

Instructor: Maria Vazquez

Grade level/ Course: 3rd Grade/Math

Title of the Unit: Exploring Equalities using Relational Thinking

Title of the Lesson: Whole Number Addition Balancing Both Sides of an Equation When There is one Unknown

1. **Mathematical Practice to Focus on during this Lesson Study.**

**Other Overarching Goals (not specific content goals)**

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| Make sense of problems and persevere when solving them. Look for and express regularity in repeated reasoning. |

1. **Important Mathematical Concepts of this Lesson**

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| The students will develop understanding of the meaning of the equal sign and develop a concept of equivalence. They will be able to find an unknown in an equation. |

1. **Research Question**

What do you hope to learn about student understanding/misunderstanding from this lesson study? What evidence will be collected during the lesson?

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| We hope to learn how students understand and misunderstand the equals sign in an equation. For example, they may think that you can only read an equation from left to right. They may or may not realize that the equation has to balance in order to be true. |

1. **Important Mathematical Concepts and Progression of this *Unit***

Think about and discuss the entire mathematics unit. Examples of units are multiplication/division of fractions or solving simultaneous equations. In what order will you teach the important topics in this unit? How do the topics build from each other and lead to each other?

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| 1st: Show equalities/inequalities ONLY using manipulatives and oral language/academic vocabulary (not paper, pencil, symbols except for the equal sign, or numbers). Make sure to talk about the number of cubes.  2nd: The students will develop understanding of the meaning of the equal sign and develop a concept of equivalence. (Equations with addition using numbers 0-9 but no unknowns)  3rd: Students will be able to find an unknown in an equation.  4th: Revisit concept 2 and 3 using larger number  5th: Start the concept progression again with subtraction and then with multiplication and division. |

1. What **mathematical understandings (prior knowledge)** do students have that serve as resources for learning this unit’s topic?

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| Students need to know basic number sense and how to put numbers together using addition. They have used and recognize the equal sign and an addition sign. |

1. What **mathematical misunderstandings** do students have that cause them to have **difficulty** with this unit’s topic?

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| Students think that the equal sign means “get an answer”. They also think that the equals sign needs to come after the plus sign. They think that a number sentence must have an operation. Many students added all of the numbers in the equation showing that they do not understand what the number sentence is asking. |

1. **Unit Assessment.**

What are some key questions, problems, or MARS tasks (in addition to algorithmic exercises) you could ask students to assess their learning of the important ideas of this unit?

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| \*Add sentence frames to the next assessment so students are encouraged to show their thinking in words.  6 = 6 True or False  Explain your answers in words.  It is because .  10= 4 + 4 True or False  Explain your answers in words.  It is because .  See assessment for other problems. |

**Progression of Lesson**

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| **Teacher/Activity Questions** | **Things for teacher to remember/Expected student responses (Strategies)** | **What Observers should be doing** |
| **I. Anticipatory Set/Background Knowledge**  Have a student stand with an equal sign and have other students come up to balance the equation with their bodies. Ask, “Is this true? Why is this true?” | To prep/Materials needed:  Make a large equal sign for teacher.  Make equal signs for each student.  Unifix cubes- can call them “tools”, you can put them in bags if you want to  Math journals or White Boards and expo markers  Smartboard/Projector  Make sure to emphasize that there are two sides of the equation and reading it as a whole, not just from left to right. | In the classroom, we will each sit with a group of students and observe and listen to them.  When watching the video we will listen and watch. |
| **II. Activity and Instructional Structure**  Teacher puts an equation with one unknown on the board: 7 + 4 = \_\_ + 5. Teacher says, “What goes in the box to make this number sentence true? Put your thumb up when you know”. Pause for student thinking. Call on volunteers and put up their answers on the board. Try to solicit multiple responses. “Did anyone get a different answer?” This problem will remain on the board throughout the lesson and be reviewed at the end. | Pause for student thinking.  Put a dot next to repeated answers.  Common misconceptions will be 11 and 16. | We will look for student engagement. |
| Students will now take out unifix cubes, an equal sign for each student, and math journal and pencil/white boards and expo markers. Now, the teacher will go back to a more basic problem in digits to help students grasp the meaning of the equals sign. The problem will be 3=3. Teacher will ask, “Is this number sentence true. Talk to your group/elbow partner and explain”? After discussion and volunteer examples, the teacher will put up another number sentence: 2 +1 = 3. After all problems, the teacher will ask for volunteers to prove their answer and show why it is true. Students will have unifix cubes that they can use to prove their answers. | Make one equal sign per student or group.  Vary discussion by having groups share out, individuals share out, and/or equity sticks.  Stack unifix cubes together in one line and compare each side.  Starting with the number sentence 3=3 have students write the equation either on their white boards or in math journals. | We will watch for student understanding and look for specific misunderstandings.  We will listen for the types of explanations, justifications, and demonstrations.  See if the use of white boards or math journals seems to help or hinder student learning. |
| Teacher continues lesson with the following equations.  3 = 2 + 1 “Is this true? Is this equal?”  4+4=6 “Is this true?” “It’s not true because both sides are not the same. It’s not equal”.  “So what will make this number sentence true?”4+\_\_\_=6  10=4+5 “Is this true? Explain.” “It’s not true because both sides are not the same. 10 is not the same as 9. 10 does not equal 9.  “So what makes this number sentence true? 10=4 + \_\_\_.  4+3 = 3+\_  5+\_= 3+ 4 | Put a sentence strip up on the board  Q: “Is this true?”  A: “It is not true because\_\_\_\_.”  A: “It is true because \_\_\_\_\_.”  Anticipate that kids say “NO, it’s not true” to 6=4+4. “Okay, so what number will make this number sentence true?”  We expect that students will know their doubles (like 4+4) and will immediately know that the equation is not equal.  \*If the students fully understand the equal sign and relational thinking, then the teacher can introduce two unknowns (one on each side of the equal sign) to have students realize that there is more than one answer and the unknowns depend on one another.  Examples: 9= 1+ \_ +3 or 9 + \_ = 8 + \_ | We will look for the progression of student understanding and see if the order of equations introduced is appropriate.  See if sentence frames are useful to help with language production.  Monitor the use of unifix cubes. |
| **III. Closure:**  Go back to the original problem 7 + 4= \_\_ + 5 and ask students if they would like to revise their thinking. Have students use unifix cubes to do this problem and revisit the answers that are written on the board. | To prevent students from saying they are finished before they build the number sentence say something like, “Once you have the answer with your cubes put your thumb up.” | See if students have revised their thinking.  See if the use of unifix cubes helps with revisiting the original problem. |
| **IV. Assessment**  Give students the ticket out the door problem: 8+3=\_+9 | Students can use their cubes at this time.  \*Make sure to keep the ticket out the door as well as the pre and post assessments.  Teacher immediately went over the ticket out the door problem to the entire class. | See if the use of unifix cubes helps with the ticket out the door problem. |

1. **What did you learn about how students come to understand your topic? (e.g. student misconceptions, prior learning, context—situation, manipulatives, model…)**

Students confirmed our understanding of common misconceptions. For example, they said that the unknown in 7+4= +5 is 16 and 11.

We learned that the majority of students had trouble transferring from the use of manipulatives to the written equation.

We noticed that students who stood up their unifix cubes had a better grasp of how to compare them. Other students had trouble looking at both sides of the equals sign.

Downtime for students who finished a problem before other students helped students make connections between the equations and help each other.

1. **What significant changes did you make to the lesson and why did you make them?**

Projecting the number sentences rather than writing them by hand so all students will be able to see better.

Projecting more student examples and have students show and explain their thinking between problems. This will help deepen student understanding of equalities. It will specifically help students who are having trouble visualizing and creating the number sentences.

Shortened the number of equations in order to focus more on strategic problems. The problems with zero threw students off and didn’t add to their understanding. We also made this change to improve the pacing of the lesson and to focus it more on finding the unknown.

We added the use of notebooks/whiteboards in order for students to connect the use of manipulatives with written equations.

We will now have students stack the unifix cubes in order to show the meaning of the addition sign. This will help students more easily compare both sides of the equals sign and have a greater understanding of the meaning of the equal sign.

Pre/Post Assessment

Name: Date:

1. 6 = 6

True or False (circle one)

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| Explain why:  It is\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_because\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

2. Fill in the blank to make the number sentence true.

10 = \_\_\_\_\_ + 7

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| How do you know the number sentence is now true?  I know it is true because |

3. Fill in the blank to make the number sentence true.

3 + 8 = \_\_\_\_\_ + 3

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| How do you know the number sentence is now true?  I know it is true because |

4. Fill in the blank to make the number sentence true.

3+ \_\_\_\_\_ = 5 + 4

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| How do you know the number sentence is now true?  I know it is true because |