**Arrow Cards**

In this lesson, students develop an understanding of decomposing numbers to add using arrow cards. Students will connect this strategy to the number line.

**Common Core Standard:**

**Use place value understanding and properties of operations to add and subtract.**

**NC.2.NBT.5** Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure.

**Student Outcomes:**

* I can add within 100 with ease by applying strategies (composing numbers into tens and ones, using mental strategies) based on the numbers being added.
* I can use arrow cards as a tool to help me add using place value strategies.
* I can use a number line to add within 100.

**Materials:**

* Arrow Cards (One set per partner on card stock if preferred)
* Zip plastic bag to store cards
* Paper to draw a number line
* Paper to chart a problem to be displayed
* Large paper or a way to display a number line

**Advance Preparation**:

* There is a growing body of research to suggest the importance of the number line as a tool for helping children develop greater flexibility in mental arithmetic as they construct mathematical meaning, develop number sense, come to understand number relationships, and develop powerful strategies for addition and subtraction. The number line can do much more than simply help children count to 100. The number line can be used as a tool to help children function well with the various operations. The number line is a powerful visual tool for adding and subtracting.
* Arrow cards will need to be copied, cut and stored in bags prior to beginning this task. This can be time consuming, but the value of these cards and the flexibility of their use is worth the time spent in preparation.
* Students may have had opportunities to use these cards in previous grades and may understand how to line the arrows up to show the value. If not, the teacher will need to spend time “playing” with these materials prior to instruction.

**Directions:**

1. Arrow cards are distributed to students and a quick warm up is done to make sure students understand how to use the cards. For the warm up, ask students to show you 53 and review the hidden 50 in 53, Ask students to show you 38 and review the hidden 30 in 38. Have students show 85 and 58. What is the difference in these two numbers? Which is larger? How do you know?
2. Depending upon the students’ prior knowledge and work with arrow cards, the teacher may need to spend more time working with place value understanding and composing and decomposing numbers before moving to using place value strategies for addition and subtraction.
3. Present pairs of students with the problem 57 + 36= \_\_\_\_ . Ask students to use the arrow cards to solve this problem. Allow students to struggle with the problem as the teacher circulates and poses additional questions to the students. When students begin to finish have them share their solution with another set of partners and then compare solution strategies. After lots of small group discussion, pull students together and discuss how they solved the problem. Using some type of projection device, walk through the strategies used to solve the problem. Share the following solution strategy with the students. 57 is the same as 50 + 7 and 36 is the same as 30 + 6 when the numbers are decomposed. Be sure students see the visual model of this by separating their arrow cards , have students then combine the tens, and ones so that they are seeing 50 + 30, and 7 + 6. Exchange the tens for a total of 80, and exchange the ones for a total of 13. Now put these cards together so that we have 80 + 13. When students put these cards together it will look like this:

|  |  |
| --- | --- |
| 8 | 0 |
| 1 | 3 |

Now as students begin to total the problem they will see that the 80 and 10 will need to be totaled. When this happens the cards will look like this:

|  |  |
| --- | --- |
| 9 | 0 |
| 0 | 3 |

 and the sum total becomes 93.

1. If the teacher feels that students need more guidance in walking through the next problem, it can be done as a whole group. If students were successful in completing the first problem in partners then continue to allow the students to persevere in solving the next problem.
2. Give students the problem 26 + 46 = \_\_\_\_\_. Students **MUST** use the arrow cards to solve the problem. Some students will know how to use the traditional algorithm to solve this problem and will want to quickly use their abstract understanding to solve the problem. Encourage (even require) the students to use the arrow cards so they begin to understand what is happening with the algorithm.
3. Repeat the process of sharing the strategies partners used and be sure the place value strategy of composing number is modeled as shown:

|  |  |
| --- | --- |
| 6 | 0 |
| 1 | 2 |

When cards are totaled:

|  |  |
| --- | --- |
| 7 | 0 |
| 0 | 2 |

for a sum total of 72.

1. Continue this process with several problems and continue to require the use of arrow cards.
2. Using the problem we began with of 57 + 36= \_\_\_\_ ask students how it could be modeled on a number line. This should generate lots of discussion and again will depend on the prior experience students have had with number lines. Some good questions to lead this discussion would include, “Does our number line have to start at 1?” “Does a number line have to have every number marked on it?” “What could we begin with to solve this problem?” “What are the increments we could use to jump on the number line?” The teacher should model and “try” the suggestions the students give for ways to solve the problem. One efficient way to solve it problem would be:



After solving this problem, have students go back to the problems they solved earlier and create a number line to represent their solution strategy. Discuss the place value understandings used in both of these methods.

1. Ask pairs of students to come up with a problem they would like to solve, this problem would need to be approved by the teacher and may depend on the understanding of the students. It would need to be a problem that could be solved by using the arrow cards and could be represented on a number line. This would limit students in using a number over 100 (because of the arrow cards). Have pairs of students chart their problem and solution in a way that could be displayed in the classroom. Ask students to display the solution with the arrow cards and the number line on the walls and have students do a “Gallery Walk” to look at each others problems. Encourage students to make their solutions very clear and to include pictures, models, and words so that a second grader could understand how they solved the problem.

**Questions to Pose:**

Before:

Can you show me how to make 25, 57, 89, 58, 99, etc. with the arrow cards.

What does the hidden zero represent?

Explain why the zero is important.

During:

How can you use your arrow cards to help you solve this problem?

Is there more than one way to represent that number?

Can you show me another way to make that number?

Does our number line have to start at 1?

Does a number line have to have every number marked on it?

What could we begin with to solve this problem?

What are the increments we could use to jump on the number line?

What have we already learned that can help us with the number line?

How is understanding place value going to help you solve this problem?

After:

What strategy did you find most helpful in solving the problems?

How are the arrow cards and the number line alike as a strategy?

What would you say to a first grader if you were trying to teach them how to add using arrow cards?

What would you say to a first grader if you were trying to teach them to add using a number line?

**Possible Misconceptions/Suggestions:**

|  |  |
| --- | --- |
| **Possible Misconceptions** | **Suggestions** |
| Students may not have a conceptual understanding of place value so that they would think 34 is 3+4 rather than 30+4 and may not see the relevance of the zeros. | Have students build numbers with base ten blocks and compare those numbers to the arrow cards so that the students can see why the zero is important. This may take several conversations and a variety of models until students begin to understand. |
| Students with limited or no experience with an empty number line may want to put each number on the number line. Students may not know how to space the numbers on the number line so that they represent the quantity of the number correctly. | Begin with smaller numbers for these students so they can see the actual space between numbers on a number line that is marked with appropriate spacing.  |

**Special Notes:**

This task is very involved and may take several days depending on the prior experiences and the place value understandings of the students. This lesson only involves addition but the standard also addresses subtraction.

*Adapted from Partners for Mathematical Learning, 2009*

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