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Mathematics: The Language of STEM
Problem-Based Lesson Plan Format
"Leaping Tall Buildings with a Single Bound!"

CONTENT AND TASK DECISIONS

Grade Level(s):1st, 2nd

Description of the Task: SWBAT find the missing addend of a given problem.

Indiana Mathematics Content Standards:
2.CA.1: Add and subtract fluently within 100.
2.CA.2: Solve real-world problems involving addition and subtraction within 100 in situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all parts of the addition or subtraction problem (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem). Use estimation to decide whether answers are reasonable in addition problems.

Indiana Mathematics Process Standards:
PS.1: Make sense of problems and persevere in solving them.
PS.2: Reason abstractly and quantitatively.
PS.3: Construct viable arguments and critique the reasoning of others.
PS.4 Model with mathematics.
PS.5: Use appropriate tools strategically.

Mathematics Content Goals: SWBAT determine the missing addend of a given problem using the strategies of counting on and/or using a known subtraction fact; thus, increases their growing understanding of reversibility.

Language Objectives: SWBAT orally explain their answers using the mathematical vocabulary: missing addend. Students will be encouraged to use pictures, words, and symbols to support their answers.

Materials: number lines, connecting cubes, Superman figurines, 11x14 poster-sized paper, pencils and/or markers, video clip (www.youtube.com/watch?v=jTaWGDAWCYs)

THE LESSON

Before:
- Student Actions
    1. Watch and listen to a short Superman video clip showing Superman leaping from a building. (www.youtube.com/watch?v=jTaWGDAWCYs)
    2. Turn and Talk to your neighbor. Name your favorite superhero. Tell your partner what superpower you wished you had.

- Teacher Actions
    1. Elicit student responses to the question: Who shared with their side-kick (partner) that they wished they had the superpower of being able to fly? (In our class, students respond

by giving a thumbs-up on their chest.)
2. Briefly discuss the idea of leaping, as seen in the video clip.
3. Explain to students that they will use their math superpowers to help Superman leap from tall building to tall building in the city of Metropolis. Their mission will be to determine how many floors/levels Superman will need to leap from the top of their first building to reach the top of their second building.
4. Pose this question again in written form on the board. Read the question again.
   "How many floors will Superman need to leap to reach the top of your next building?"
5. Instruct students to record their mathematical thinking on their poster. Remind students that they can choose to "show" their work using words, pictures, or symbols.

During:
- Student Actions
  1. Using connecting cubes, students will construct two skyscrapers.
  2. Students will compare the buildings. Students will take their Superman figure and move him from one tower to the other. How many floors (cubes) must Superman leap to reach the top of the next building?
  3. Students will represent, using words, pictures, and/or symbols, on their poster how they arrived at their answer.
- Teacher Actions
  1. Wait for 3-5 minutes! Don't move around the room, yet. Allow students to think for themselves without teacher hints or help.
  2. After the initial "free think", travel among your individual students or groups asking open-ended questions about their buildings and answers. For example, "What can you tell me about your buildings? When Superman leaped from building to building, what did you see or think? How could you show or write about Superman's leap? As you arrived at your answer, what did you record to support your solution? What about your poster would help me solve my own problem?"
  3. Listen carefully to student responses. If students seem confused, have them reread the question on the board. Ask them to tell you the first step that they should take: build two skyscrapers, and so forth, to get them back on track.

After:
- Student Actions
  1. Students will present their solutions to their Math Cave partner by showing their constructed buildings and explaining how they solved the opening question.
  2. Select students will then present their process and solution in front of the entire class.

- Teacher Actions
  1. Choose three students to present their posters to the class. Look for examples of counting on, finding the difference, and counting back type of strategies. Highlight these methods to the whole class.
  2. If mathematical symbols were not used initially, ask students how they might use these symbols to reflect what their peer's had presented. For example, a student may have said that they started with a building 15 cubes high. Superman then leapt to the top of the second building which was 22 cubes high. By counting on from 15 to 22, they might say that they traveled 7 cubes/floors up. Mathematically this "leap" can be shown as $15+7=22$, with 7 being the unknown or missing addend.
  3. Define the term missing addend as an unknown number being added to find a sum in an

addition sentence.
4. Label one of the student-generated number sentences with the labels of addend, missing addend, equals, and sum.
5. Ask students to now identify the missing addend in each of the student examples.
6. Direct students to look at their own work and now write their own number sentence to show their reasoning.
7. Elicit previous knowledge of number line usage by reviewing how to jump along a number line. Give students a few addition problems to solve using the horizontal number line. Solve 5+3=? Ask students to describe how they arrived at their answer. Ask clarifying questions, i.e. on what number did you land? How many jumps did you take to get there?
8. Ask students: How is a number line similar to your building? How is it different? How might you use a number line to solve a missing addend problem like we just did?

ASSESSMENT

Observe:
Students will be asked to construct two new buildings from which Superman will leap. Once again they will answer the question of how many floors will he have to leap to reach the top of the second building. The teacher will observe which strategies the students used to solve the problem, did they utilize different mathematical tools, such as the number line, and finally, can they identify which number represents the missing addend. Teacher will then make notations in the student's assessment folder.

Ask:
What can you tell me now about your buildings?
When Superman leaped from building to building, what did you see or think this time?
How could you show or write about Superman's leap?
As you arrived at your answer, what did you record to support your solution?
If you used a different way of solving the problem, what made that way more likable to you?