



FLUENCY,
ORIGINALITY,
FLEXIBILITY &
ELABORATION

Thinking
strategies
to enhance skills
of analysis,
creativity,;
and problem
solving.

ZOO KEEPER PROBLEM

Lesson Description: Students solve a story problem by using various problem-solving strategies. Students are encouraged to generate many possible solutions, consider connections and expand their solutions to produce a justifiable answer.

Pre-assessment/Prior Knowledge:

- Students have indicated a basic understanding of the Fluency, Originality, Flexibility & Elaboration strategy through the introductory lesson (p. 26).

SOL/POS Objective:

Mathmatics

- 3.8 The student will solve problems involving the sum or difference of two whole numbers, each 9,999 or less, with or without regrouping, using various computational methods, including calculators, paper and pencil, mental computation, and estimation.
- 3.4 The student will recognize and describe a variety of patterns formed using concrete objects, numbers, tables, and pictures, and extend the pattern, using the same or different forms (concrete objects, numbers, tables, and pictures).

Problem Solving/Applications

Students:

- use strategies (e.g., build a model, make a chart or table, make a list, make a graph, use a pattern, work backward) and appropriate materials to solve routine and non-routine problems
- solve problems using a plan
- identify information needed and not needed to solve problems
- share and explain thinking about how a problem is solved

Instructional Strategy:

Generating and Testing Hypotheses- Students apply multiple strategies to formulate and test solutions to a problem.

Materials:

- *Problem Solving Strategies* (p. 75)
- *Zoo Keeper Problem* (p. 76)
- large chart paper (for the small group sharing option)

Enduring Understanding:

- Fluency of ideas creates multiple approaches to problem solving.
- Selecting a specific problem solving strategy allows you to focus on multiple solutions.
- Elaboration is the process of embellishing an idea by adding details.
- Flexible thinking looks for connections between ideas and goes beyond the obvious

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Teach and Explore Strategy:

- **Introduce the problem:** Distribute the problem to the students. Read the problem together and clarify any questions regarding the parameters of the problem. If students decide to use zero as an option then the problem generates many more answers. The teacher may elect to eliminate zero as an option or allow the class to discuss the option and decide as a whole. (Note: The best way to determine all the answers for this problem is to create an organized list. The goal of this lesson should not be to get the problem correct with all the possible answers, but to encourage fluency of thinking and for each student to showcase his/her ability to generate multiple answers. The teacher will be able to assess the student's mathematical thinking by observing the each student's approach to the problem.)
- **Guided Practice:** Ask students to provide a couple of possible answers. Discuss with students that because of the communicative property it will be easy to duplicate answers. For example, 1-2-3-9 is the same answer as 2-9-1-3. Encourage students to look for original solutions without repeating the same solution. Brainstorm problem solving strategies. (*Problem Solving Strategies*, p. 75) Encourage students to select a strategy and create a plan for solving the problem.
- **Practice:** Allow students to work independently or with a partner on this problem. Allow enough time for a closure discussion as the students will not find all the alternates in one session. While the students work, the teacher should mingle among them looking at their thinking and problem solving strategies.
- **Share/Closure:** Ask students to share their thinking and how they attempted to solve the problem. Ask students if anyone feels they have found all the possible answers. Ask students to defend their thinking and rationale. Create a class list of solutions. Have students check the solutions for duplications. In this elaboration stage, allow for new ideas and flexible thinking to emerge. As students collaborate as a whole class, someone may discover a better method for recording the answers. Allow students' problem solving and mathematical thinking to guide the teacher's instruction. *An alternate to whole group teacher directed sharing:* After the independent practice time, assign students to groups of 4 or 5. Each group should be given a large sheet of chart paper. The group members will merge all their solutions into one solution that represents the groups thinking. Each group should be given time to share their solution to the problem to the whole class.

Assessment Evidence:

- Teacher observations
- Zoo Keeper Problem completed work
- Whole group solution discussion or small group solution
- Student discussions



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Metacognition:

- Why is fluent thinking important for mathematicians?
- Why is it important for mathematicians to elaborate on the ideas of other mathematicians?
- How does flexible thinking allow you to try a new approach?

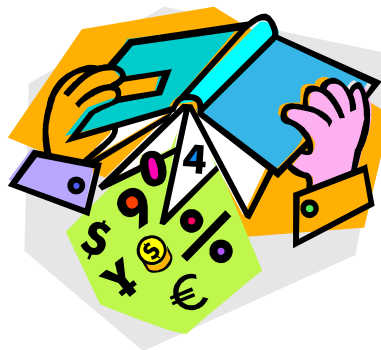
Extensions:

- To make this problem easier or harder, change the number of tigers.
- Allow students to find all the solutions by working on this problem over time and creating a class chart where any student can record options. Eventually, students should come to the realization that to prevent duplications, the list has to be organized in a systematic fashion. This extension will lead to more elaboration and original thinking.



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Problem solving strategies



Thinking strategies to enhance skills of analysis, creativity, and problem solving.

1. Act it out or use objects
2. Draw a picture
3. Look for patterns
4. Guess and check
5. Use logical reasoning
6. Make an organized list
7. Make a table
8. Solve a simpler problem
9. Work backwards/sdrawkcab



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Student Name: _____

Date: _____



The Zoo Keeper Problem

*The zoo keeper has a problem. He just received 15 tigers from Asia to add to the zoo's collection. However, he only has four habitat cages available. The zoo keeper must decide how to display the tigers to the zoo's visitors. The owner of the zoo likes for each animal habitat to be unique so the zoo keeper knows he cannot put the same number of tigers in any two cages. **How many different ways could the zoo keeper display the tigers in the four habitat cages so that each habitat has a unique number of tigers?***

Pick a problem-solving strategy and show your thinking.

Teacher
Resource:
Sample
Transparency

Student
Handout