Teacher Instructions: Keeping Track of Animals

Grade Level: K – 2

Task: Keeping Track of Animals

Standard: Patterns, Functions, and Algebraic Concepts

A farmer saw…
4 heads
10 legs
3 tails
What animals did she see?

Context – From the Task Author: This task can be given to children at any time during the school year, and does not have to be given to coincide with any particular math unit. Students do need the skill of one-to-one correspondence to address this problem.

What the task accomplishes…

- This task not only shows a child's mathematical thinking but also offers insights into problem solving in a more general way.
- The task is open-ended, and allows for creativity. For instance, some students may say "The cow is behind the bush with only her head and feet showing."
- Finding the right combinations and agreeing on exactly what counts as a tail can lead to very interesting discussions that can be nicely integrated with science topics.

What students will do…

- The children will use diagrams and/or manipulatives to guess and check for correct solutions. Some students will be able to label their work with numerical phrases.

Time Required: This task will require 35 to 45 minutes to complete.

Interdisciplinary Links: This task can be used with a unit on farming or with a unit on nature. It also provides a good opportunity for students to classify and categorize. The task can be adapted to fit other units as well. For instance, if you are studying a particular country, you could ask children to identify what animals native to that country they might have seen.

Teaching Tips…

- Have many different types of manipulatives in the classroom available for students to explore. Pompoms, yarn, toothpicks, and pictures or plastic models of farm animals might be good options.
- It also might be helpful to show students a picture book about farms before attempting this task, to open their minds to possible creatures they might find.
- Brainstorming a list of farm animals beforehand with students could also be beneficial.

Suggested Materials: Manipulatives such as pompoms, yarn, tooth picks, or other materials that students could use to represent head, tails, and legs, pictures or books about farm animals.

Possible Solution…

- ✓ This is an open-ended problem with many different solutions.
- ✓ The specification of 4 heads limits the number of animals to 4.
- ✓ Three of the four must have tails.
- ✓ The combinations of legs must equal 10, and be made of 4 addends: 4 + 2 +2 + 2 or 4 + 4+ 2 + 0 (O could be a snake, fish, etc.).

Benchmark Descriptors:

- ❑ The benchmark descriptors and rubric are designed to help the teacher analyze student thinking and understanding at each of the four performance levels.
- ❑ The descriptors are generalizations of what student work could look like.
- ❑ It is not possible to anticipate every answer a student can give, so in scoring student work the teacher must use these generalizations to come to their own conclusions as to where a student is performing on the assessment.
- ❑ It is recommended that teachers create their own task specific rubric by listing the specific math skills that would make up each section of the four performance levels.

Novice

- ✓ The novice will not address more than one parameter of the task and will focus more on drawing animals than arriving at a mathematically correct solution.
- ✓ Little or no math language will be used and no mathematical reasoning will be evident.

Apprentice

- ✓ The apprentice will address some but not all of the parameters of the task.
- ✓ The apprentice will use accurate math notation, and will use diagrams to communicate some correct parts of a solution.
- ✓ Some mathematical reasoning will be evident.

Practitioner

- ✓ The practitioner will achieve a correct solution, and will use accurate and appropriate math language and representations to communicate.

Expert

- ✓ The expert will achieve a correct solution and will use mathematical notation to communicate the correctness.
- ✓ The expert will also make mathematically relevant observations about the solution such as "If there are only four heads, then there can only be four animals." or “Ducks have half as many feet as cows."

Rubrics: There are 3 rubrics included in this task: a kid’s rubric, a general rubric, & a task specific rubric. Teachers may want to introduce the kid’s rubric after the students have had a chance to begin the problem so they can begin the process of self-evaluation. This should be done before the teacher assesses the student work so the students can make their own revisions to the task.

The general rubric provides an overview of the descriptors at each of the performance levels. The task specific rubric is designed to anticipate student responses and provide examples of student work at each of the performance levels to assist teachers in their evaluation process.

APS Mathematical Standards…

❖ **The math standards stated for this task are aligned to the APS Draft Standards 2000.**

Number Sense and Operations: Learners will demonstrate number sense through experiences with meaningful mathematical problems while focusing on number meaning, number relationships, relative effects of operations, and multiple representations to communicate sound mathematical thinking.

Kindergarten:

Number Meaning: Make connections of number names with quantities to 10.

- **Demonstrate** that the meaning of a number does not change no matter how objects are grouped.

Number Relationships: Compare groups and sets to understand the relationships of quantities.

- **Sort and classify** objects according to similar attributes.

Number Operations: Model addition and subtraction situations

- **Combine and separate** 2 single-digit numbers using pictures, stories, and objects to model the situation.
- **Record** numerical information.

First Grade:

Number Meaning: Extend and model number names of quantities to 20.

- **Represent and explain** the meaning of the numbers 1-20.
- **Form and count** groups of numbers up to 20.

Number Relationships: Increase the number of objects in groups and sets to understand the relationship of quantities.

- **Build** combinations of numbers to 20 in different ways using pictures, stories, and objects to model the combinations.
- **Estimate and compare** quantities up to 20 using pictures, stories, objects, and symbols to model the situation.
- **Explore** the concept of ordered pairs by linking commonly paired objects.
- **Sort, order, and classify** according to more than one attribute.
- **Determine** relationships between and among small numbers.

Operations: Model and record addition and subtraction in a variety of ways.

- **Develop** strategies and estimation skills for solving addition and subtraction problems.
- **Record** strategies for solving, combining, and separating problems using pictures, numbers, equations and words.

Second Grade:

Number Meaning: Extend and model number names with quantities to 100.

- **Develop** fluency and **apply** patterns in skip counting.

Number Relationships: Demonstrate fluent and flexible use of numbers.

- **Construct** relationships of quantities to 18 using part-part whole.

Operations: Model, solve, and record solutions to addition and subtraction problems using a variety of strategies.

- **Invent, present, defend, develop, and record** multiple strategies to solve addition and subtraction problems.

Patterns, Functions, and Algebraic Concepts: Learners will demonstrate an understanding of algebraic concepts through experiences with meaningful mathematical problems while focusing on discovering, describing, modeling and generalizing patterns and functions, representing and analyzing relationships, and finding and supporting solutions.

Kindergarten:

Patterns: Demonstrate effective skills to establish an understanding of the predictability and reliability of recurring patterns.

- **Identify, describe, and extend** patterns with familiar objects in both classroom and real-life situations.

First Grade:

Patterns: Extend patterning skills that establish a sense of predictability and reliability to more complex patterns.

- **Identify, describe, and extend** patterns with familiar objects in real-life situations.

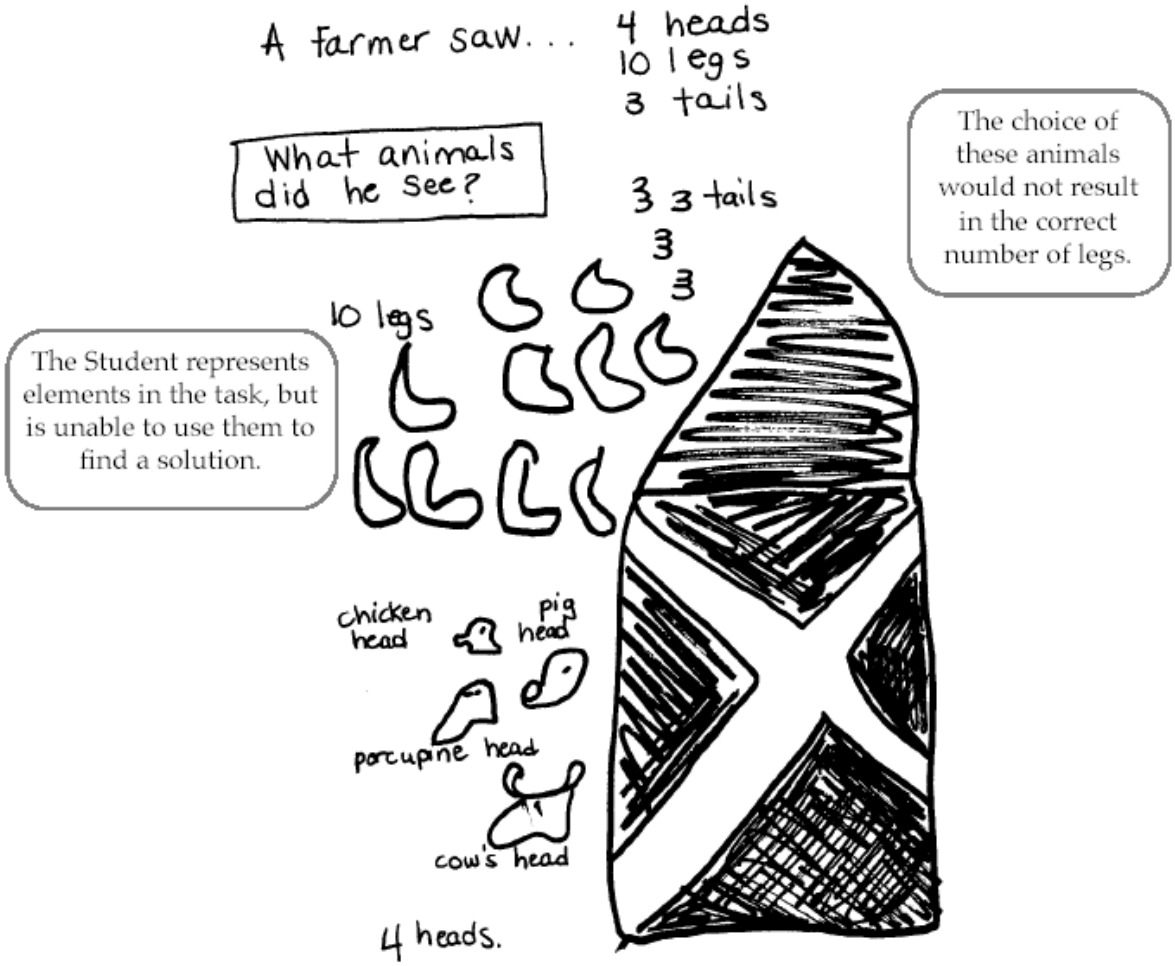
Second Grade:

Patterns: Extend patterning skills to include numerical patterns and problem solving, focusing on the predictability and reliability that patterns allow.

- **Recognize, describe, extend, and create** a wide variety of patterns.

Benchmark Papers

Novice



Apprentice

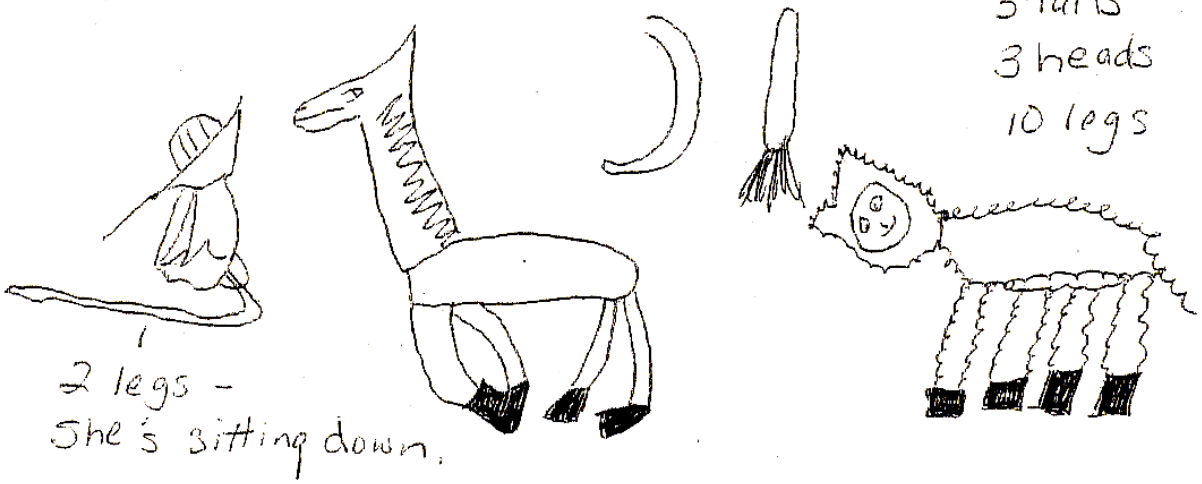
An attempt to solving the task is made.

A Farmer saw. . .

4 heads
10 legs
3 tails

No math language is used.

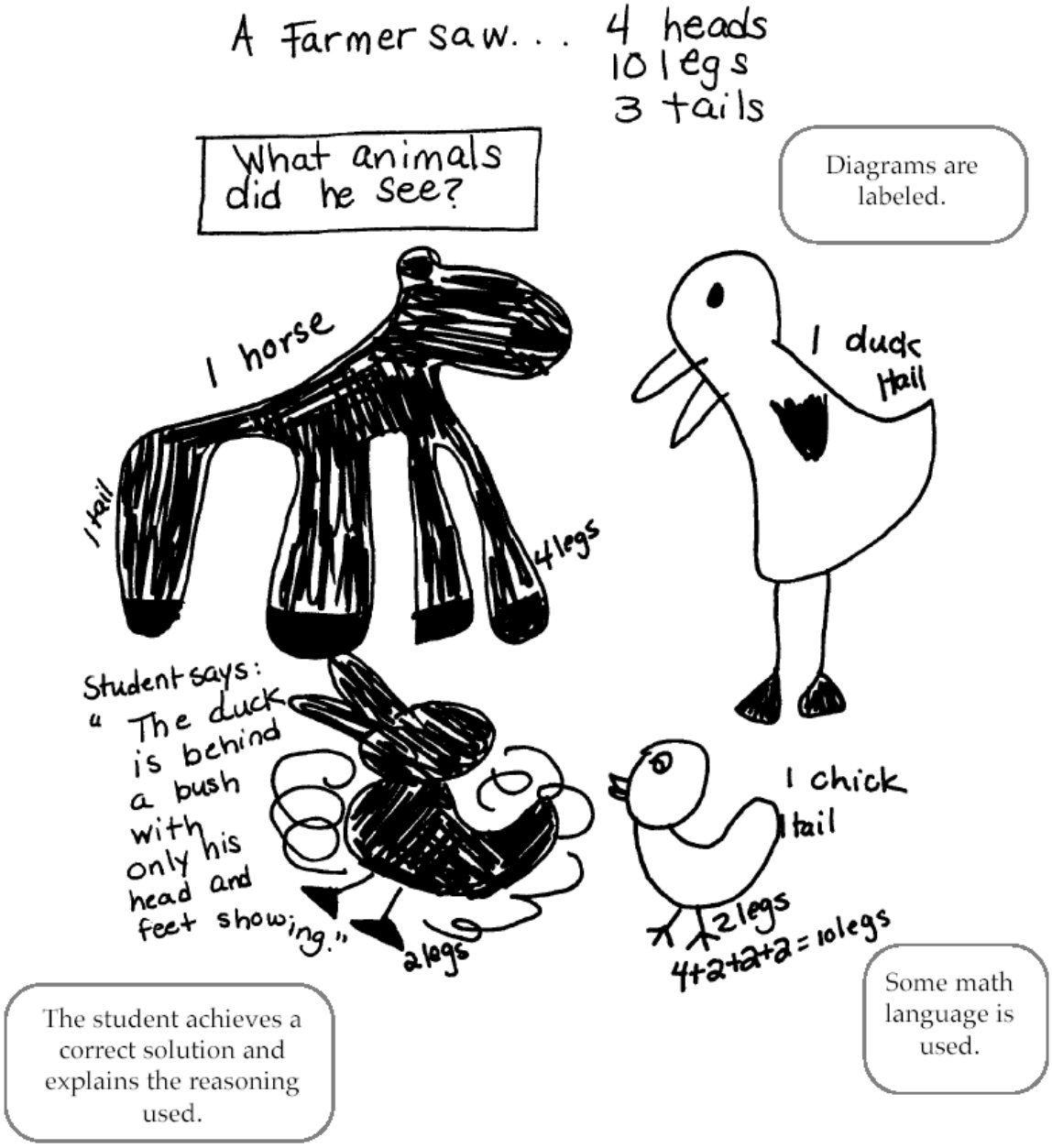
What animals did he see?



Parts of the solution are addressed, and are correct.

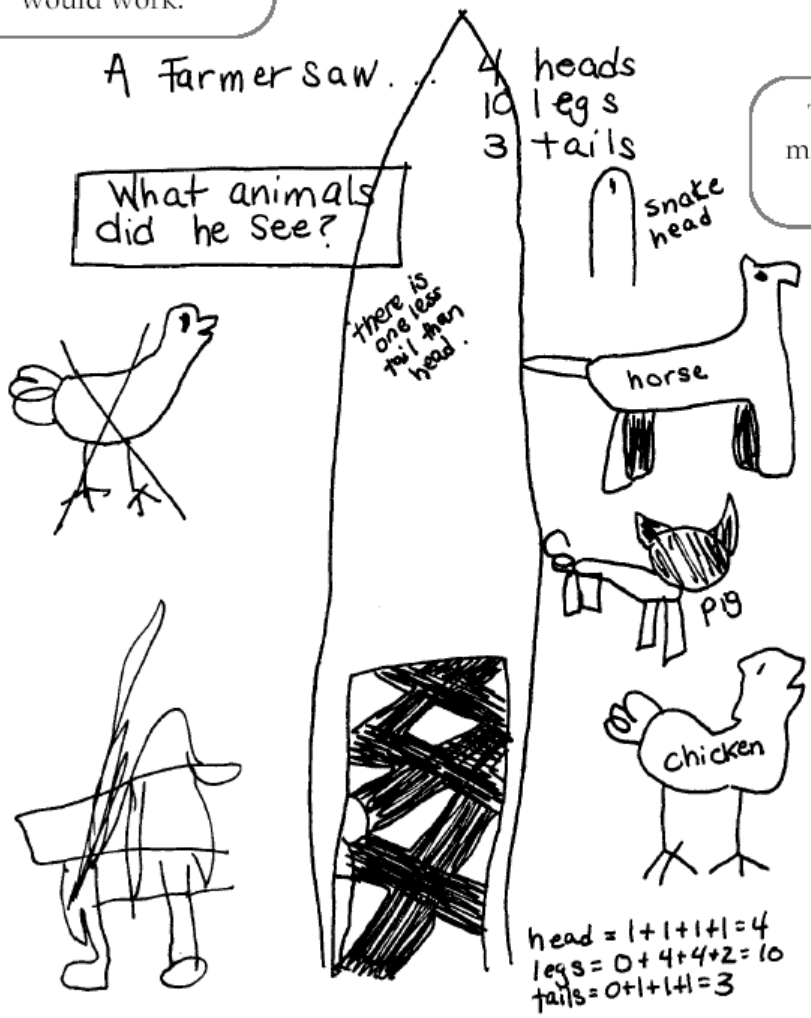
8 legs are used above, and here the student struggles to deal with the other 2.

Practitioner



Expert

There is evidence that the student needed to try several options before finding one that would work.



The student makes a mathematically relevant observation.

Accurate math notation is used to verify the solution.