Hamsters

Sam's hamster, Applesauce, had 8 babies. There were 4 males and 4 females. When they were 6 weeks old, the females each had 6 babies, 3 males and 3 females. This time Sam knew he had to separate them as soon as they were old enough. The pet store told him to put them in separate cages for 4 weeks. How many cages will Sam need if he wants the females and males in different cages? The pet store also told him there should be no more than 3 hamsters in each cage. Show your cages below. Please explain how you got your answer.

Grade Levels Pre-K-2

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Context

Sam is a boy in the second grade next door. He had a similar problem with multiplying hamsters. His teacher decided to have the class try to figure out a way to solve the problem. If you have classroom pets, this would be a great way to solve the multiplying before it begins.

What This Task Accomplishes

This was an assessment of students' ability to follow, organize and solve a multi-step problem. It was originally introduced to a second grade class who found it challenging, so I thought I would give it a try with first grade. I expected that most would find it overwhelming, and I was surprised to find many able to get close to a solution or on the track to a solution. I was interested to find out which students were able to understand the idea of exponential growth. It was also interesting to see how they used the available information to record their solution. Developmental readiness becomes very apparent in this problem.

What the Student Will Do

Some students will add up all or some of the numbers on the sheet (8 + 6 = 14, 8 + 4 + 4 + 6 + 3 + 3 = 28, and many other varieties). With this total, they will make cages for no more than three hamsters. Some students will be so engaged in drawing the hamsters that they lose track of the problem and their solution. Some students will not include Applesauce. Some students will draw boxes or circles around the symbols to show cages. Some students will explain with words and/or equations. Some students will mix males and females while focusing on keeping no more than three hamsters in each cage. Some students will show males and females having babies.

Time Required for Task

20 - 30 minutes

Interdisciplinary Links

Science - Discuss and observe differences between males and females, pet care and the consequences of population growth in nature.

Social Studies - Look at population growth and how that effects communities and resources (classroom, school, town, country and world).

Teaching Tips

Encourage them not to do detail drawings of cages or hamsters.

Brainstorm symbols to show female and male hamsters (m/f, circle/square, x/o, etc...).

Discuss the meaning of "no more than three hamsters in a cage" so that it is clear that there could be one to three hamsters in a cage.

Discuss the reason behind separating males and females. During this discussion, you may find yourself nervous about the developmental appropriateness of the discussion or where the discussion may lead with certain students. I found the first graders to be very matter of fact and surprisingly focused on the problem rather than how those babies got there. They simply stated that when males and females are together, they make more babies.

Suggested Materials

- The task written on a sheet with space available to show solutions.
- Manipulatives - colored blocks, Unifix cubes, beans, etc. (for those who want to use them)

Possible Solutions

There are 21 possible solutions. There could be 12 - 33 cages to keep the females separate from the males and to have no more than three hamsters in a cage. After all the students had completed the problem, we went over the solutions with 12 cages and 33 cages.

Benchmark Descriptors

Novice
This student did not find a solution. S/he used an inappropriate procedure by adding up some of the numbers in the task. His/her strategy did not help solve the problem. There were so many errors in the mathematical procedure that the problem could not be solved. The explanation (18 hamsters rather than cages) is unrelated to the problem.

Apprentice
This student showed evidence of mathematical reasoning when s/he explained that dividing the hamsters would keep the males and females apart. This student did not complete the problem because s/he had difficulty organizing and recording the solution. S/he understood that no more than three hamsters could be in a cage and that males and females needed to be apart, but

s/he did not show all the hamsters or put them all in cages.

Practitioner
This student has a broad understanding of the problem. S/he clearly showed all the hamsters except for Applesauce. This student used effective mathematical reasoning and terminology. This student found a correct solution as s/he was explaining his/her solution and realized that there was a male in a cage with females. S/he decided to make two cages with two males and two cages with two females to keep them from having any more babies.

Expert
This student shows a deep understanding of the problem including the ability to identify the appropriate mathematical concepts and information for its solution. This student used an efficient strategy of symbols to represent the gender of the hamsters, boxes to represent the cages and equations to explain his/her reasoning. There is precise use of mathematical terminology and all the steps are included so that the reader does not need to infer how and why decisions were made. This student was able to explain the total number of males and females in each generation to help him/her verify the results.