Hard Workers

Beavers are very strong animals. They have sharp teeth that they use to build dams that are an average of 65 feet long. The Vermont Fish and Wildlife Group has reported that the teeth and jaws of a beaver are so powerful they can cut down a tree 20 inches thick in 15 minutes.

If a family of 4 beavers were building a dam and they worked for 1 hour, how many inches of tree could they use for their dam? Remember to show your work.

Grade Levels Pre-K-2

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Context

This problem was given to a group of first and second graders who have been working on counting by larger numbers. Some of them have begun work with time, but are beyond the routine clock lessons. They needed a more in-depth look at time, and this problem provided them with a chance to apply their knowledge of both number crunching and time in a meaningful way.

What This Task Accomplishes

This task allows students to apply and engage their understanding of multiplication, skip counting or addition through the determination of the number of inches a beaver family can cut through. The task also allows the students to work with a systematic list to organize their work.

What Students Will Do

Many of the students began by first looking at the work of one beaver. They all learned quickly that they needed to figure out how many minutes or 15-minute intervals there were in one hour. This was tough for some. Many of them needed prompting, and some even resorted to using the Judy Clocks to work this out. It was hard for them to show this in their work, therefore, some of the work does not reflect the whole process they went through. You can clearly see that some students neglected to look beyond the work of one beaver, showing they did not clearly understand the problem. Nearly all of the children set up some sort of representation, whether it was a chart or a drawing. As the students worked, I circulated and offered assistance as needed. The most assistance needed was in the beginning stages in making sure students understood the problem.

Time Required

45 - 60 minutes

Interdisciplinary Links

The links to social studies and science are obvious - both through the study of habitats of beavers. The main emphasis that we placed on the integration of this problem was through the work of time and measurement. The students were working with time and needed a chance to apply their understanding. The topic of beavers came up, as one student in this group is an avid beaver watcher. In fact, he goes to the beaver pond with his parents every night, yes every night!

Teaching Tips

Make sure that the children know early on in the problem that a family is more than one. You might want to introduce this by using their own family as an example - what makes up their family, and the number of people in their family. You should also point out that there might be some additional information in the problem that is not needed (i.e. the average dam is 65 feet long.). Adapting this task for special needs is something that can simply be done by changing the numbers. A family of two beavers might be more appropriate for a child at this developmental stage. One other easy way to alter this problem is to change the 15 minutes to 30-minute intervals as this is something that most second graders are able to grasp quickly. Fifteen-minute intervals does pose a challenge for many.

Suggested Materials

- Manipulatives that can be used for one-to-one correspondence
- Judy clocks - both individual and one large one for the class demonstration
- Calculators (for some students)

Possible Solutions

The correct answer is 320 inches of tree.

Benchmark Descriptors

Novice
This child read the problem and then shows the work of adding 15 four times to get 60, but does not tell us why. One can assume that s/he is determining how many 15 minute intervals it takes to get to 60 minutes or one hour. The student then shows the addition work of four 20s beside that, but again lacks an explanation as to why. Following that the student does a multiplication sentence which is in no way related to the problem and is not explained. A picture of beavers split into four segments is evident, but this does not add to the reader's understanding of what the child did to solve this problem. Overall, this child has a sense of the problem, but was not able to carry out the operations or explanations in a clear manner.

Apprentice
This child shows many unsuccessful attempts, but the child's determination and commitment to solving the problem is evident. The student began by creating a representation (table) that has labels for time, inches and "4 B" (which I assume means four beavers). The table is accurate,

but the last column of "4 B's" is not completed. Under the table the student wrote what s/he did to solve the problem and clearly comes up with the correct answer of 320 inches, but the answer does lack labels and evidence of how 320 was determined. The use of math language is limited to that found in the problem or that of simple computation.

Practitioner
The Practitioner clearly understands the problem, especially the fact that a beaver family is four beavers. The Practitioner will determine the number of inches a beaver could cut through in one hour, some with the use of an accurately labeled chart, and others with the use of a math sentence, linked with a textual explanation. The Practitioner will find the correct answer of 320 inches. The Practitioner's explanations leave little for readers to figure out on their own.

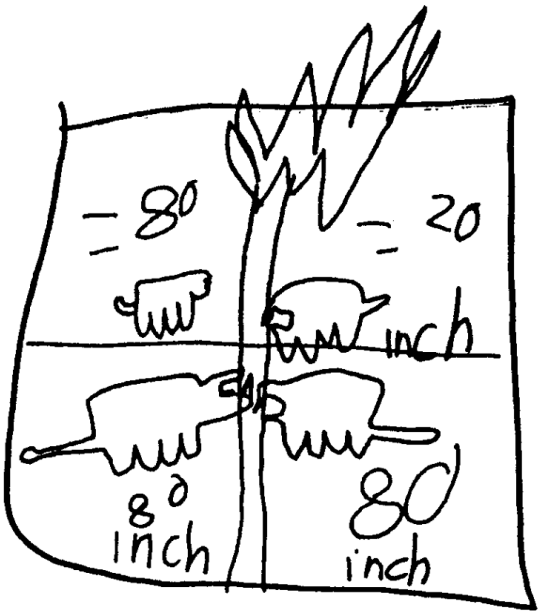
Expert
An Expert will find a correct answer of 320 inches, and will communicate the solution clearly using more sophisticated math language. The Expert will verify the correctness of his/her solution, and may make mathematically relevant comments such as determining that each beaver did one quarter of the work, or that each cut through 80 inches of wood. In this particular case, the student used a line graph to show change over time.

Novice

+15 +20
15 +20
+15 +20
+15 20
60 80

60
X80
4800

Not able to carry out operations or explanations clearly.

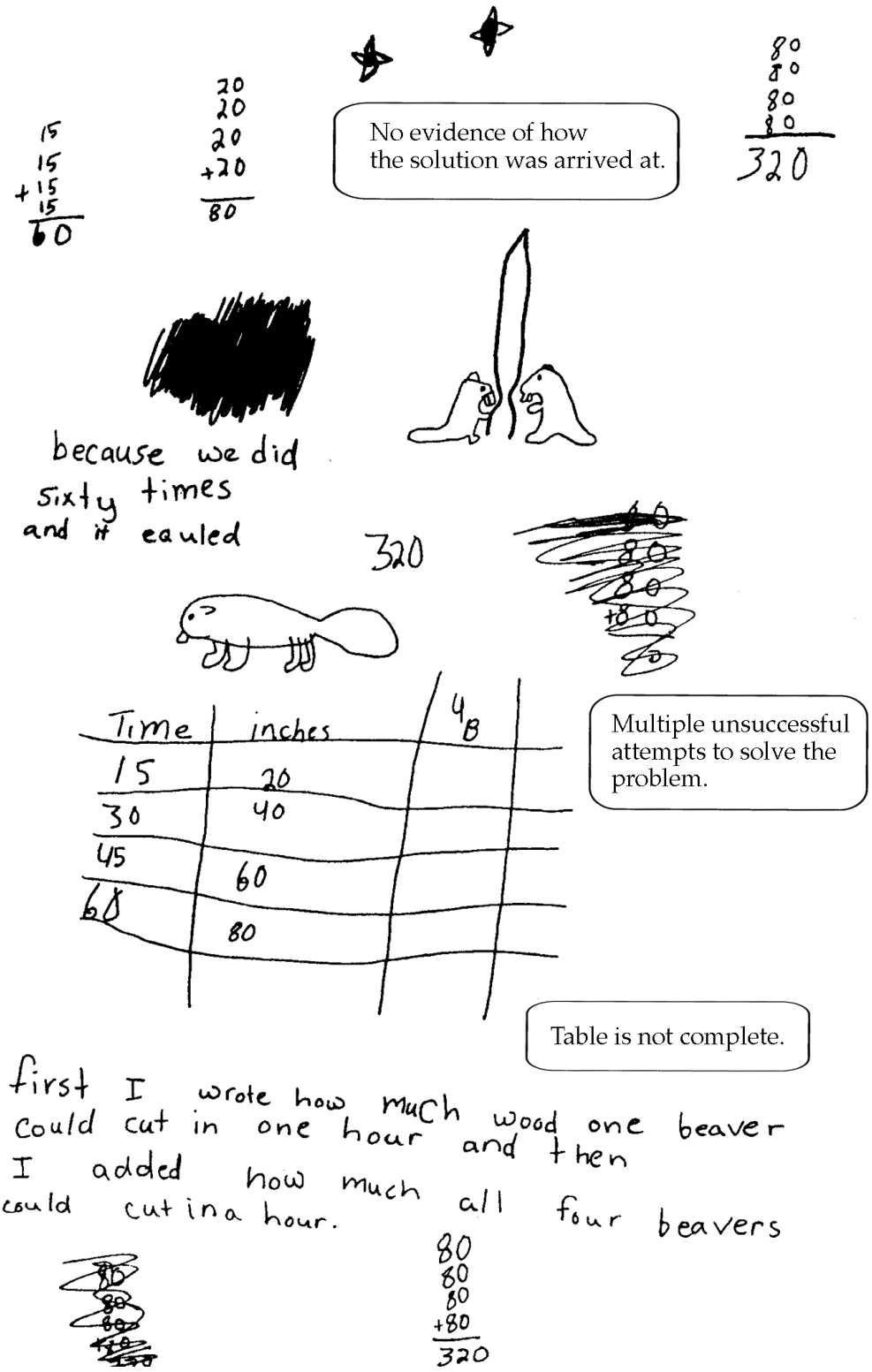


80
+80
+80
+80
0=4800

4800 becos 60X80

140
+140
280

Apprentice



Hard Workers

Practitioner

15 minutes 4 times equals 1 hour. I added 20 4 times because beavers can go throe 20 inch thick trees in just 15 minets.

20
20
20
+20
80

80
+80
160

20+20+20+20=80 80+80=160

One beaver ate throe 80 inches in one hour 4 beavers ate throne 320 inches in one hour all together.

1
160
+160
320

Procedure is appropriate and clearly laid out.

Clear explanation.

Expert

Remember to show your work.

1 Beaver's Work (1 hour)

15 minutes x 4 = 1 hour

20 inches x 4 = 80 inches

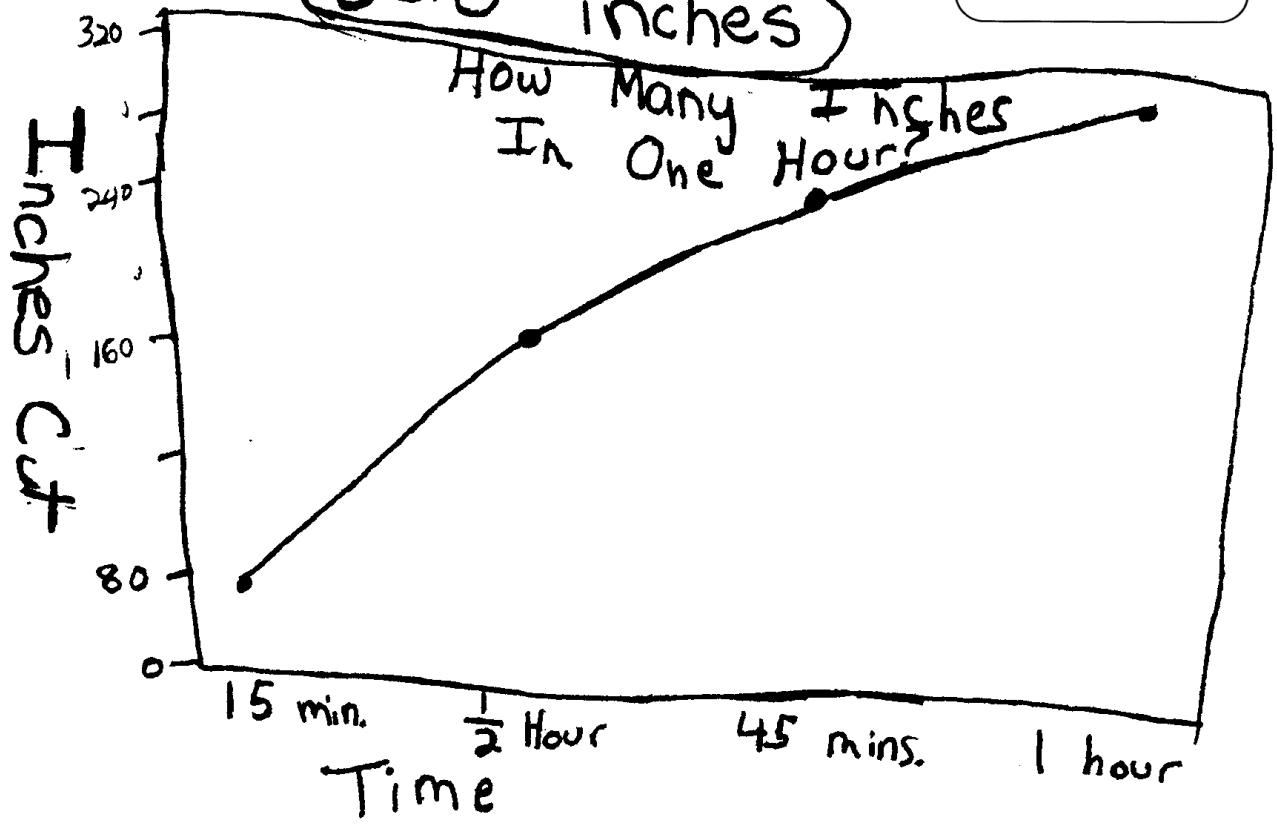
Clearly laid out procedure.

80 (inches)
x 4 (beavers)

320 inches

How Many Inches In One Hour?

Excellent graph showing change over time.



Hard Workers

Expert

How I Did This

First I figured out how many inches one beaver can cut in an hour I know that if you multiply 15 X 4, the product is 60, which is how many minutes there are in an hour. So if I multiplied 20x4, the product would be how many inches of wood one beaver could cut in an hour. I multiplied it and the product was 18. If I multiplied that by 4, because there are 4 beavers, it would be how many inches of wood (thickness) 4 beavers can cut in 1 hour. The product of that equation is:

320"

Connections:

If it was a family of 5 beavers, you would just add 80 more inches, 1 beaver's work, and the sum would be 400 inches.

See graph for beaver's progress.

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