Shovel, Shovel, Shovel

Enough snow!! All of the melting snow is causing damage to Dr. Lehner's home. He needs to hire a couple of people to shovel off his decks, (if you have ever seen his house, you would know he has quite a few). Since Dr. L. enjoys seeing students take responsibility. . . he offers the job to Upper Unit students.

Dr. L. says when the job is completed to his satisfaction; he will pay $48 to the shovelers to share as they see fair. Oh, yes, Dr. L. will not let the work begin until he hears the plan for sharing the money and makes sure that everyone agrees.

If there are 3 decks and 6 shovelers, how do you think the work and money should be shared?

The deck sizes:

Deck A: half the size of deck B

Deck B: 80 square feet

Deck C: 120 square feet

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Grade Levels 3 - 5

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Context

The class was working on multiplication, so we did some beginning area concepts along with multiplication. I wanted to do a problem that appeared to be real world that involved area and that might also check students' division concept and equal parts.

What This Task Accomplishes

This task is a multi-step problem that has more than one strategy. It involves division as well as area and money. Drawing a diagram to help solve the problem seemed natural to many students.

What the Student Will Do

Most students started by thinking about what the decks might look like and to draw the decks on graph paper. The connection between sharing evenly and the division algorithm was clearer for some than others.

Time Required for Task

45 minutes

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Interdisciplinary Links

This task works well with discussions about money, sharing and work.

Teaching Tips

If your area does not have snow, you might think about raking leaves off decks, painting or staining decks.

Suggested Materials

Graph paper

Possible Solutions

The $48 is divided evenly among six students so each student gets $8. And a total of 240 square feet is divided evenly among six students so each student needs to clear 40 square feet (in any arrangement of 40 square feet).

Benchmark Descriptors

Novice
This student tried unsuccessfully to draw the decks and is applying inappropriate concepts to solve the problem. There is no evidence of reasoning. S/he has two shovelers working at each deck regardless of the size of the decks. The student also does not deal with the amount of money each student should receive.

Apprentice
This student does not have a complete solution indicating that part of the problem was not understood. S/he uses a strategy that is successful in figuring out how much each deck should be worth, but does not seem to understand that the money is going to go to individual students for clearing the decks. The decks are drawn correctly and there is evidence of mathematical reasoning as the student explains the rationale for sharing the $48.

Practitioner
This student has a broad understanding of the problem. They share the amount of money and the area of the decks evenly using division. S/he uses effective reasoning, there is a clear explanation of the strategy and the representation is accurate.

Expert
The solution shows a deep understanding of the problem. Notice there are two different solutions. And in fact, the second solution is made to a different scale. The first solution has one square = one square foot and the second solution has one square = four square feet. The second scale makes for a more efficient representation. There is a clear and effective

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explanation and connects division and fractions to their strategy.

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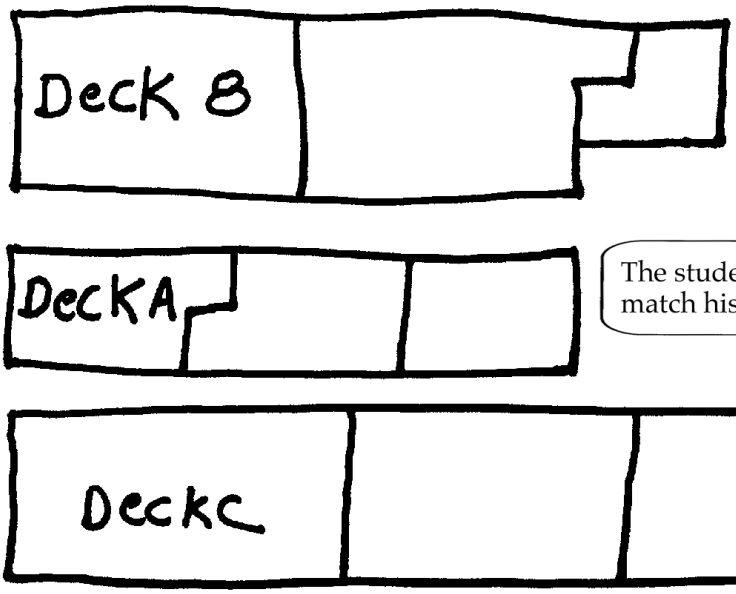
Novice

one box is 2 square feet.
2 shovelers to each deck

The solution lacks reasoning.



The student's diagrams do not match his/her solution.

The student obtains an incorrect answer for part one of the task, and neglects part two of the task.

$4+4=$8

DeckA First I just said half of 48 is 24, so if A is half the size of B then whatever B's money is half that much
$8, $8, $16 $16

B Deck should be B's then I said what 2 numbers equal 24 one being twice as much as the other and I got 8 and 16 B got 16 A got 8. B is four squares up and C is 6, 2 more, A is 2 up So I added how much A got ($8) and how much B got ($16) and

C Deck it equaled $24 so C gets $24. A is equal to 8 dollars B is equal to 16 dollars and C is equal to 24 dollars.

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Apprentice

The student uses some correct reasoning.

The student lacks mathematical representation.

$4+4=$8

Deck A First I just said half of 48 is 24, so if A is half the size of B then what ever B's money is half that much
$8+$8=$16 $16

B Deck should Be B's then I said what 2 numbers equal 24 one being twice as much as the other and I got 8 and 16 B got 16 A got 8. B is four squares up and C is 6, 2 more, A is 2 up So I added how much A got ($8) and how much B got ($16) and
$12+12=$24

C Deck it equaled $24 so C gets $24. A is equal to 8 dollars B is equal to 16 dollars and C is equal to 24 dollars.

Some basic math language is used.

The student does not address the amount of work each person should do.

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Practitioner

1. First I drew the area of each deck

The student communicates using accurate and appropriate math language.

2. Then, because their are 6 shoulers I divided the decks into 6 equal parts. The area of all the decks put together is 240 square feet. So, 240 square feet divided by 6 is Forty. Thenefore, each shovler will shovel 40 Square feet. Now the work is equal.

B. So, since deck A is 40 feet 1 shouler will be on deckA 2 ondeck B, because deck B, is 80 squarefeet 2 areas of 40 square feet. ON Deck C, there will be the 3 shovlers because there are 3 areas of 40 squarefeet Now the Money.

The student labels each part clearly so the reader can easily follow the solution.

The student uses correct reasoning to obtain a correct solution to this part of the problem.

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Practitioner

4. Since there are 6 shovelers the Money should be divided in to 6 equal parts Dr. L will Pay 48 $1. 48 divided by 6 is 8. So that means each shooler is paid 8 $ dollars.

Now the Money and Pay is EQUAL!!

The student obtains a correct solution to this part of the problem.

PROBLEM SLOVED

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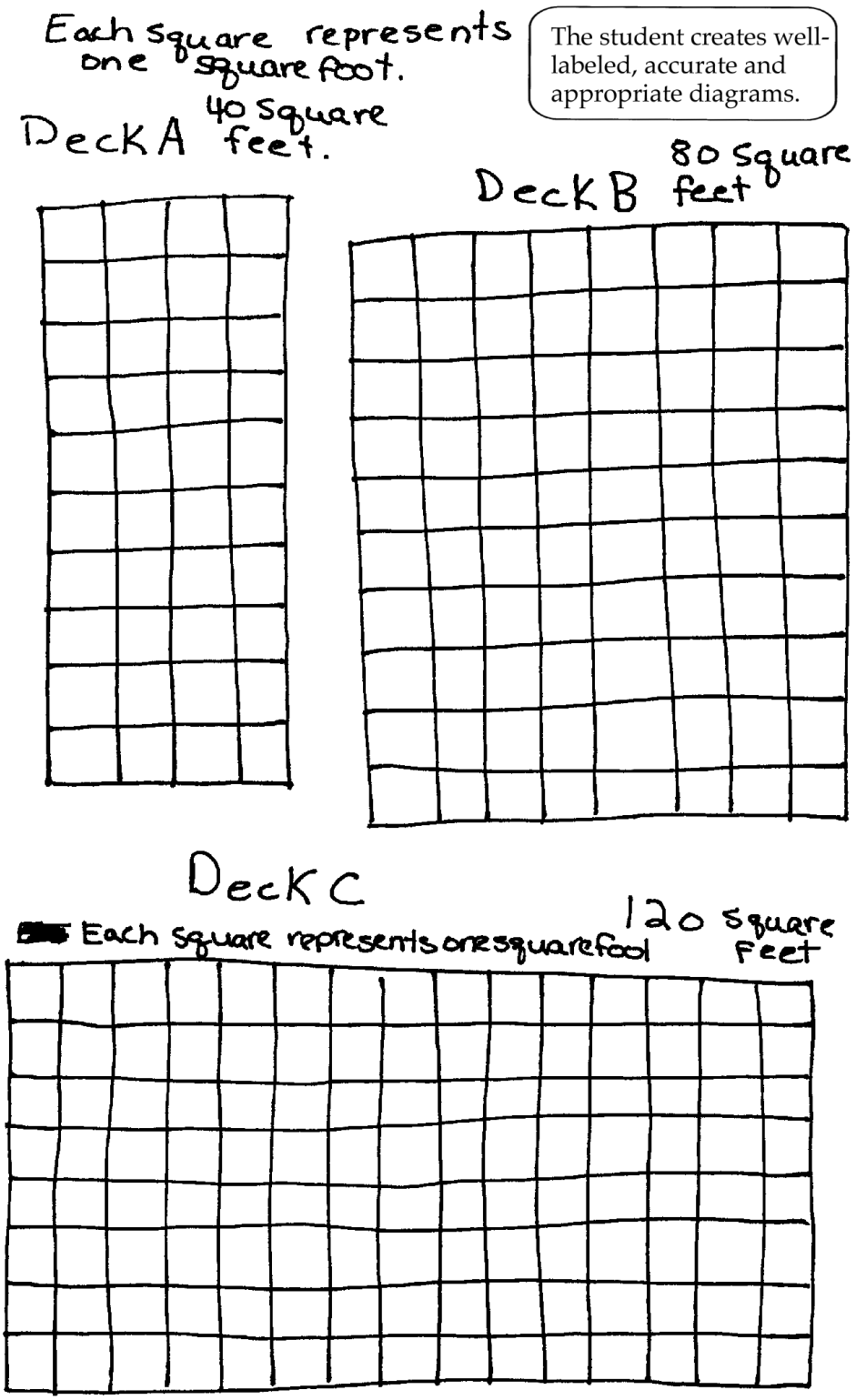
Practitioner



The student creates well-labeled, accurate and appropriate diagrams.

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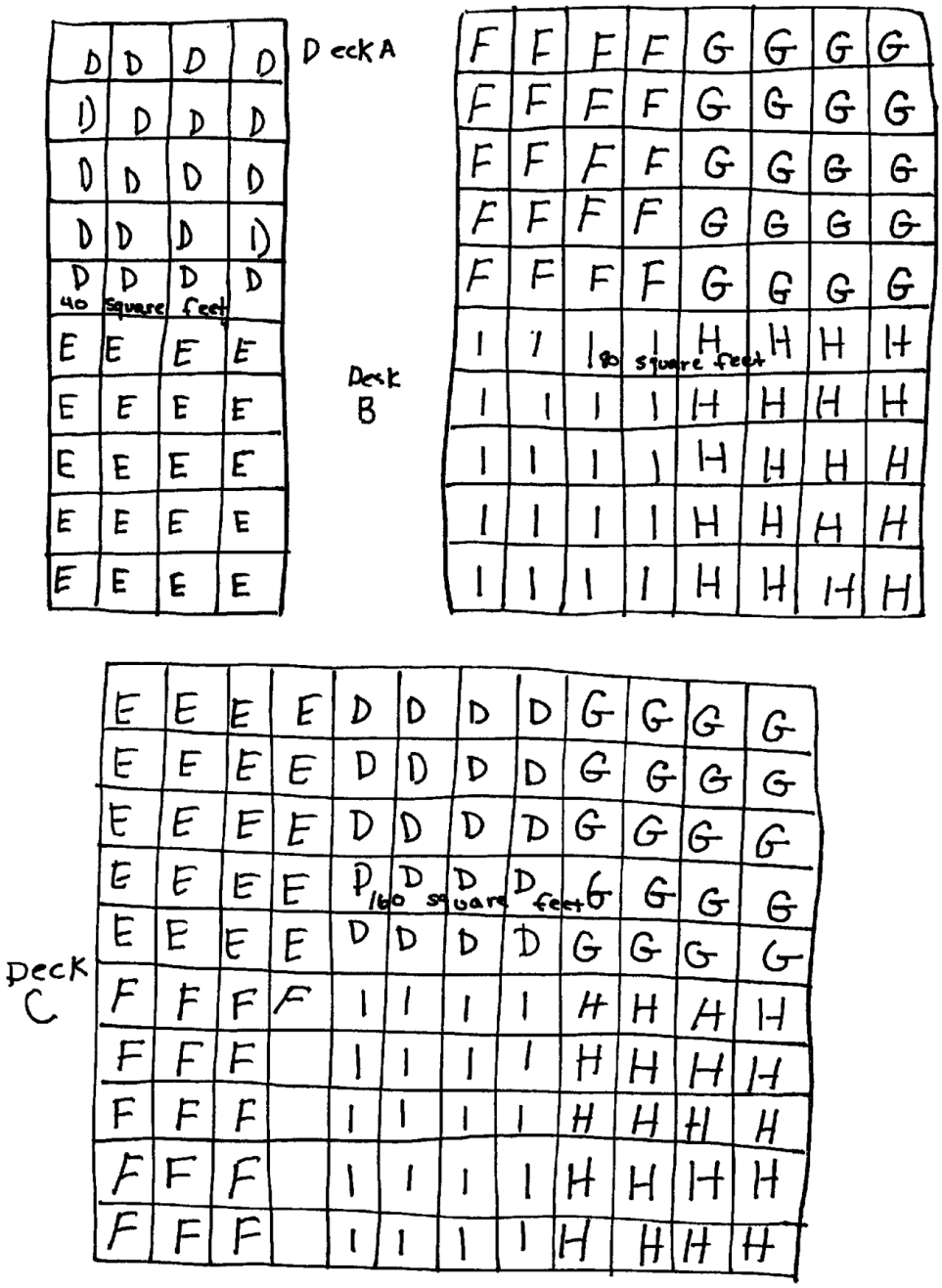
Expert



Diagrams are accurate and appropriate.

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Expert

The money will be spilt equaly between each child Each child will get $8.00.

The student makes mathematically relevant observations.

$$\begin{array}{r} \$8.00 \\ \$6.00\overline{)\$48.00} \end{array} \text{ or } 6\overline{)48}^{\,8}$$

on deck F each person will sovel 1 half of the deck
on deck B each person will sovel $\frac{1}{4}$ of the deck
on deck C each person will sovel $\frac{1}{6}$ of the deck.
2 Childeren will sovel deck A because it isn't very big.

4 Childeren will sovel deck B because it is twice the area of deck A and deck A only had to childeen soveling so I doubled the people.

All of the Children will sovel Deck C because it is 3 times the area of Deck A and 2 times the area of deck B. for deck C I multipled the Children working on deck B by 2 and got 6. I decided to do that because Deck C is twice the area of Deck B.

$$\begin{array}{r} 3 \\ \times\ 2 \\ \hline 6 \end{array}$$

The student explains his/her reasoning.

The student shows how his/her solution was obtained.

The student communicates using accurate and appropriate math language.

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