Math Hunt: Providing Children with Real-World Problem Solving Experiences

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The theme of providing opportunities for real-world math problem solving runs through every issue of *delta-K*. Allowing children to experience real-world problem solving is an essential pedagogical exercise because many children simply do not make the link from the set of rules and procedures learned in the classroom to their application in everyday experience (NCTM 1989). To provide experiences for real-world problem solving, we need to find problems that are *real* to students (Swenson 1994) and that challenge them to apply procedural knowledge. The Math Hunt, a scavenger hunt for answers to real-world math problems in the school and surrounding community, provides a real-world experience that *is* real to students.

Finding Problems in the Real World

We designed a series of problems that made use of information available at a nearby strip mall, as well as in and around the school. The goal was for the children to solve various everyday math problems with the information found at the various locations or stations. We also wanted to introduce students to common problems that allow for a range of problem solving strategies to help students develop multiple, flexible strategies. Our target group was Grades 2–3 students. The children were given a clipboard with problems to solve at different locations or stations (for example, the nearby convenience store, drug store, bank, gas station or school playground). Each group was made up of two Grade 2 and two Grade 3 students. The group was given a bag of resources to help in their problem solving, including a calculator, clock board and a tax table.

We identified a number of target concepts from the Grades 2–3 math curriculum, including identifying information necessary for problem solution, estimation, comparing results, graphing and computation. Each problem required information to be obtained from the specific station (hair salon, convenience store, school parking lot) to solve the problem.

We made every effort to develop problems relevant to the children and for which they had appropriate background knowledge. At the same time, we wanted the problems to provide a unique challenge to the children and allow them to discuss mathematics while problem solving (Hauk 1995). To this end, we developed problems for which a variety of problem solving strategies were necessary. For example, one question asked at the neighborhood restaurant (Appendix 1), "Is it cheaper to buy a cheese burger and onion rings (O'rings) or a cheese donair and french fries?", required identifying appropriate information from the menu, computation and comparison. We broke down more complex problems into solution components and asked separate questions for each stage. For example, a problem regarding the height of a slide on the playground was broken down into questions regarding estimation of the slide's height, possible problem solving strategies for determining the height, actual height calculation and comparison of the estimated and calculated height.

In addition, we developed problems whose nature and solutions ranged from relatively concrete (How much would it cost you if each of you bought a 1-L bottle of pop?) to more abstract (How could you figure out how many children can stand under the overhang to the back entrance of the school?). We developed 11 problems that we anticipated would take 5–10 minutes each to complete.

Going on the Math Hunt

Appendices 1–3 show examples of the children's solutions. At a small restaurant, the children selected meals and determined the cost. The example in Appendix 1 indicates that the children decided on an 8-inch pizza. They then identified the price on the menu, determined the GST from the tax table and added up the costs. At the neighboring convenience

store, children determined prices, calculated tax and determined change for items posted in the window. The children in the group that completed the sheet in Appendix 2 determined the costs for hot dogs and bottles of pop; they then discussed whether it would be cheaper to buy a meal at the convenience store or next door at the restaurant.

At a local drug store, a poster in the window displayed photo developing prices. The children had to identify appropriate prices, determine price per picture to develop two different rolls of film, compare these prices and determine the most economical type of film to develop. Interestingly, the small roll of film worked out to be more economical to print, and the children discussed why this might be so.

On the school grounds, children estimated height and length of a playground slide, then had to determine how to measure the distances with a metre (yard) stick and a ball of yarn as optional supplies. Although most groups unrolled the ball of yarn along the slide and measured the length of the yarn, one group formed a human chain along the slide and then measured each other's heights. The children also graphed colors of cars in the parking lot (Hitch and Armstrong 1994) and discussed color popularity (Appendix 3). Color groupings ranged from basic categories, such as red, brown, blue, and white, to more exotic colors.

An adult (parent volunteer, teacher or principal) accompanied each group as a problem-solving resource. The guidelines for parent volunteers assisting the children are shown in Appendix 4. Some children needed extensive adult intervention, including assistance in identifying important information, selecting appropriate procedures, writing out the problem solution from dictation and checking the results. Some children required little adult assistance.

Evaluating the Math Hunt Experience

After the Math Hunt, the children completed individual written evaluations of their experience. Appendix 5 shows the evaluation provided by a Grade 2 child. In response to the first item requesting something new the child had learned, the child described a potent problem solving strategy of estimation. Other children's responses included general revelations, such as "That math is wherever you go," "When shopping, use math" and "Math is used in many things," as well as specific skills, for example, "How to do GST (tax)," "I learned to estimate," "How much a litre (of gas) costs" and "I learned that you can use string to measure things." We were amazed by the number of children (over 50 percent) who commented that they discovered during the Math Hunt how rules and procedures they learned in class had relevance for operating in the world outside of the school.

Children generally liked a station either because it was challenging to them ("You were allowed to do lots of problems," "And I got to add the GST" and "Because it took the longest") or because of the open-ended nature of some problems ("Because I liked when we could choose the food").

Similarly, children were more likely to *dis*like a station because the problem was not sufficiently challenging ("Because it didn't take that long"; "They were too easy"). One child's least favorite station was the playground slides where the children estimated and then measured the height and length of the slide: "Because I had to wind up the wool."

Suggestions from the children for another math hunt mostly consisted of elaborating on the problems they had been given. One child provided an elaborate problem: "Go into the store and look for good food and put all the good candies together and add their prices up."

Although our evaluation of the Math Hunt was almost as positive as the children's, we did identify some concerns. For example, some parent volunteers needed more preparation for guiding the children in problem solving than the handout shown in Appendix 4; one parent admitted she did not know how to figure GST herself so she was not sure how to help the children figure out the tax. We also needed more time to complete 11 stations; some groups did not complete all the problems in the time allotted (1.5 hrs). Given the diverse nature of the problems we developed, next year we may have separate Math Hunt events for measurement, time and money concepts.

Summary: How to Organize a Math Hunt

Specific learning objectives must be identified. These objectives should include allowing children to solve real-world, personally relevant and intellectually challenging problems. We designed our first Math Hunt for Grades 2–3 students; problems can be developed for any curriculum level.

The children were carefully grouped so that more-experienced children could assist less-experienced children. We also made the groups small to allow all children to participate (Farivar and Webb 1994). Younger and/or less skilled children could identify

the information necessary for solving the problem, for example, finding the window poster that shows hot dogs; older and/or more skilled children could complete the calculations, for example, computing the total cost of the hot dog purchase, including GST.

The school and surrounding neighborhood abound with real-world, child-relevant math problems. We need to identify these problems and help the children experience them to provide a bridge from school-based mathematics lessons to the world outside the classroom.

References

Farivar, S., and N. M. Webb. "Helping and Getting Help—Essential Skills for Effective Group Problem Solving." *Arithmetic Teacher* 41 (1994): 521–25.

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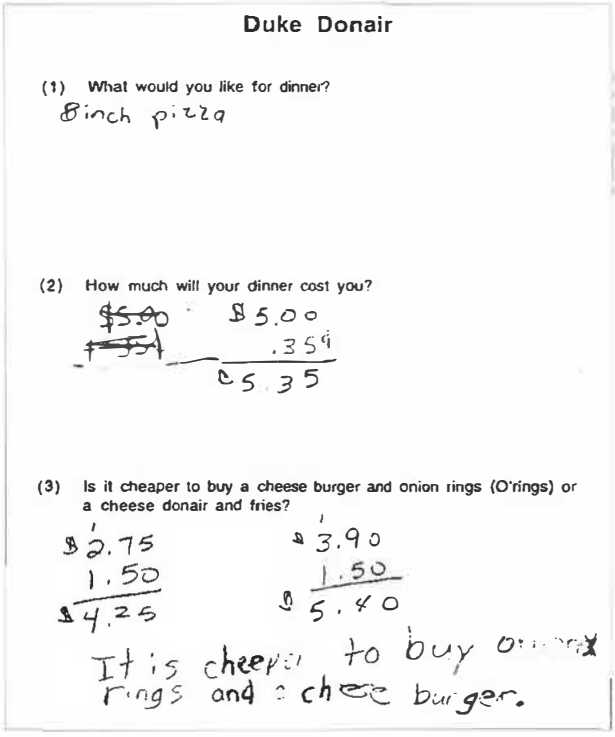
Appendix 1



Duke Donair

(1) What would you like for dinner?

8 inch pizza

(2) How much will your dinner cost you?

$5.00 + .35¢ = $5.35

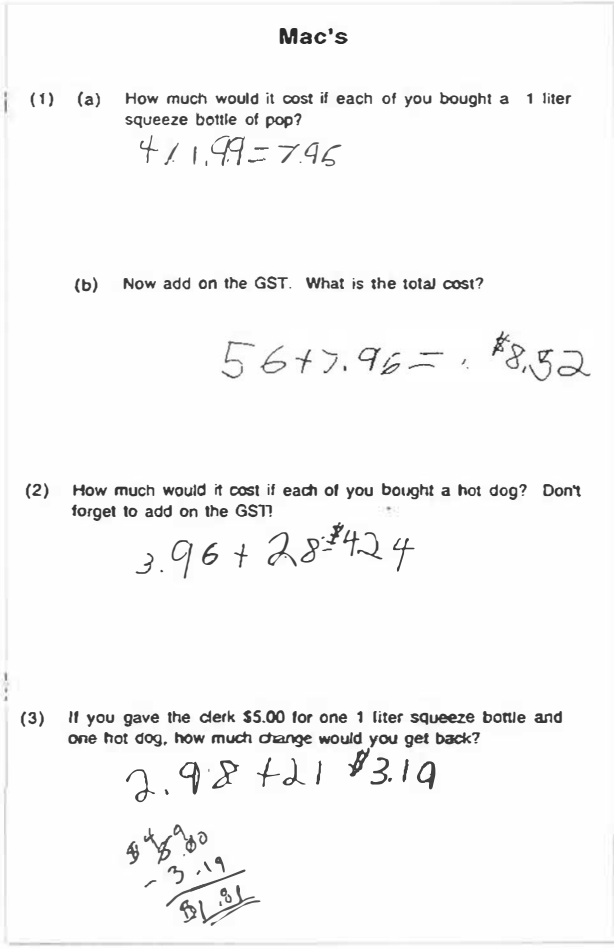
(3) Is it cheaper to buy a cheese burger and onion rings (O'rings) or a cheese donair and fries?

$2.75 + 1.50 = $4.25

$3.90 + 1.50 = $5.40

It is cheaper to buy O'rings and a chee burger.

Appendix 2



Mac's

(1) (a) How much would it cost if each of you bought a 1 liter squeeze bottle of pop?

4 / 1.99 = 7.96

(b) Now add on the GST. What is the total cost?

5 6 + 7.96 = $8.52

(2) How much would it cost if each of you bought a hot dog? Don't forget to add on the GST!

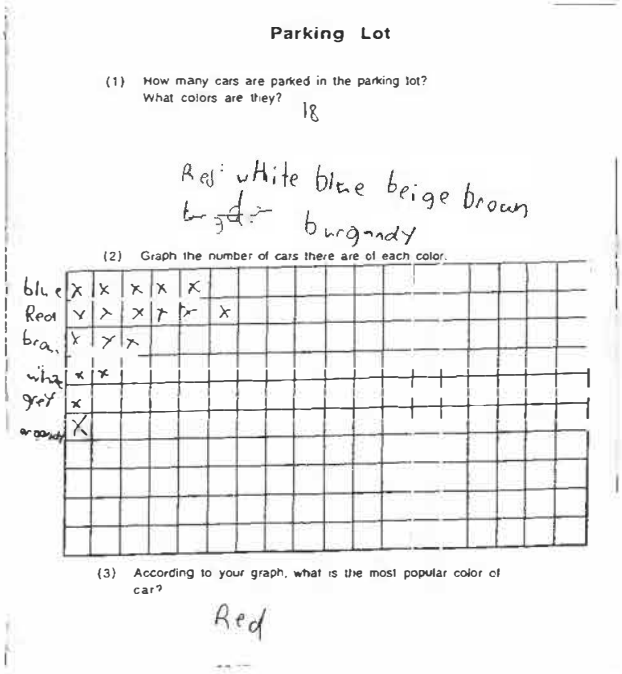
3.96 + 28 = $4.24

(3) If you gave the clerk $5.00 for one 1 liter squeeze bottle and one hot dog, how much change would you get back?

2.98 + 21 $3.19

$5.00 − 3.19 = $1.81

Appendix 3



Parking Lot

(1) How many cars are parked in the parking lot? What colors are they?

18

Red white blue beige brown burgundy

(2) Graph the number of cars there are of each color.

(3) According to your graph, what is the most popular color of car?

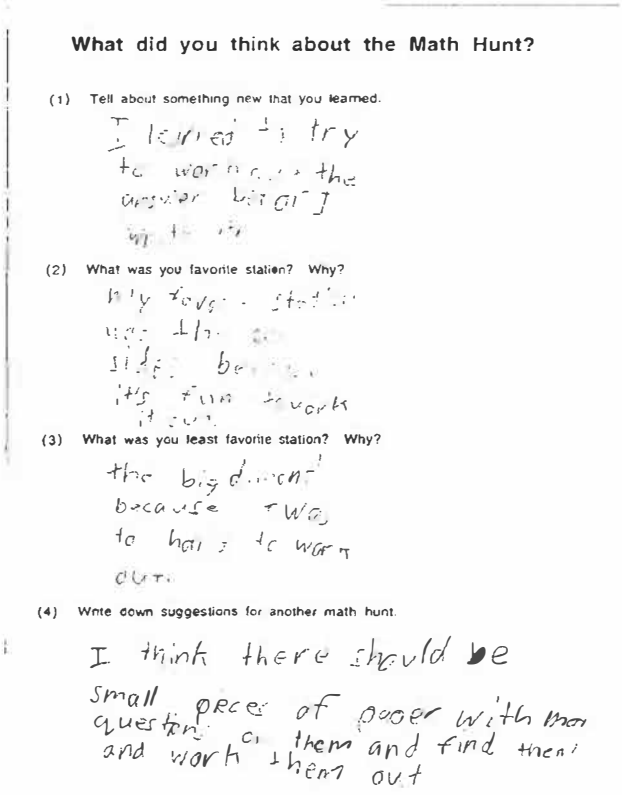
Red

Appendix 4

Suggestions for Parent Leaders

- ★ Have the students read the problem carefully.
- ★ Remember that we want the students to solve the problem themselves. But you may need to provide some hints. Ask them questions to help them, but don't give too much help. Some questions may be the following:
  - ★ What is the problem asking?
  - ★ What information do you know?
  - ★ What do you have to find out?
  - ★ What problem solving strategy could you use?
    - ★ Could you draw a picture?
    - ★ Could you guess and check?
    - ★ Could you check for patterns?
    - ★ Could you work out the calculation?
  - ★ Did you look back to see if your answer makes sense?

Appendix 5



What did you think about the Math Hunt?

(1) Tell about something new that you learned.

I learned to try to work out the answer [illegible]

(2) What was you favorite station? Why?

My favorite station was the [illegible] because it's fun to work it out.

(3) What was you least favorite station? Why?

the big dinent because I was to hard to work out.

(4) Write down suggestions for another math hunt.

I think there should be small peces of paper with mor question on them and find them and work them out