

Student-to-Student Mentoring in a Rich Problem- Solving Environment



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How to access this presentation

www.geekymathteacher.com
under presentations

<http://bit.ly/NCTMmentor>



Beginnings

- Math Forum - www.mathforum.org
- EnCoMPASS



EnCoMPASS
*Emerging Communities
for Mathematical Practices
and Assessment*



What we noticed...

.... about our students problem-solving

- they struggled to effectively communicate their mathematical ideas
- they had difficulty thinking deeply about problems
- they often didn't analyze their work to look for alternative strategies or for correctness
- they were focused on the "right" answer

Goals

- improve their mathematical communication
- deepen mathematical thinking
- encourage student metacognition
- focus on getting away from “the right answer”



What we wondered?

- How could we encourage our students to take more risks in their problem solving?
- How could we encourage students to explain their work more fully?
- How could we push their mathematical thinking?

How?



Noticing and Wondering

Mentoring across the miles



Revision Partners



Online collaboration

My Three Dogs [Problem #2752]

My neighbor has three pet dogs, named Fifi, Maxx, and Sparky. Last week he took his beloved pets to the vet for their annual health check-ups and shots. The doctor weighed them as part of the examination. Upon returning home, my friend told me the animals' weights in an unusual way. He said:

- "Together Fifi and Maxx weigh 72 pounds."
- "Maxx and Sparky have a combined weight of 86 pounds."
- "Lastly, the sum of Sparky's and Fifi's weights is 35 pounds."

How much does each dog weigh?



I just used guess and check in the calculator.

Before

How did we get started?

Reduce “risk” level

- Scenario



Eating Grapes

On Monday Angela ate some grapes. On Tuesday she was hungrier and ate six more grapes than she ate on Monday. Each day that week she ate six more grapes than the day before. After she had eaten her grapes on Friday she had eaten 100 grapes in all.



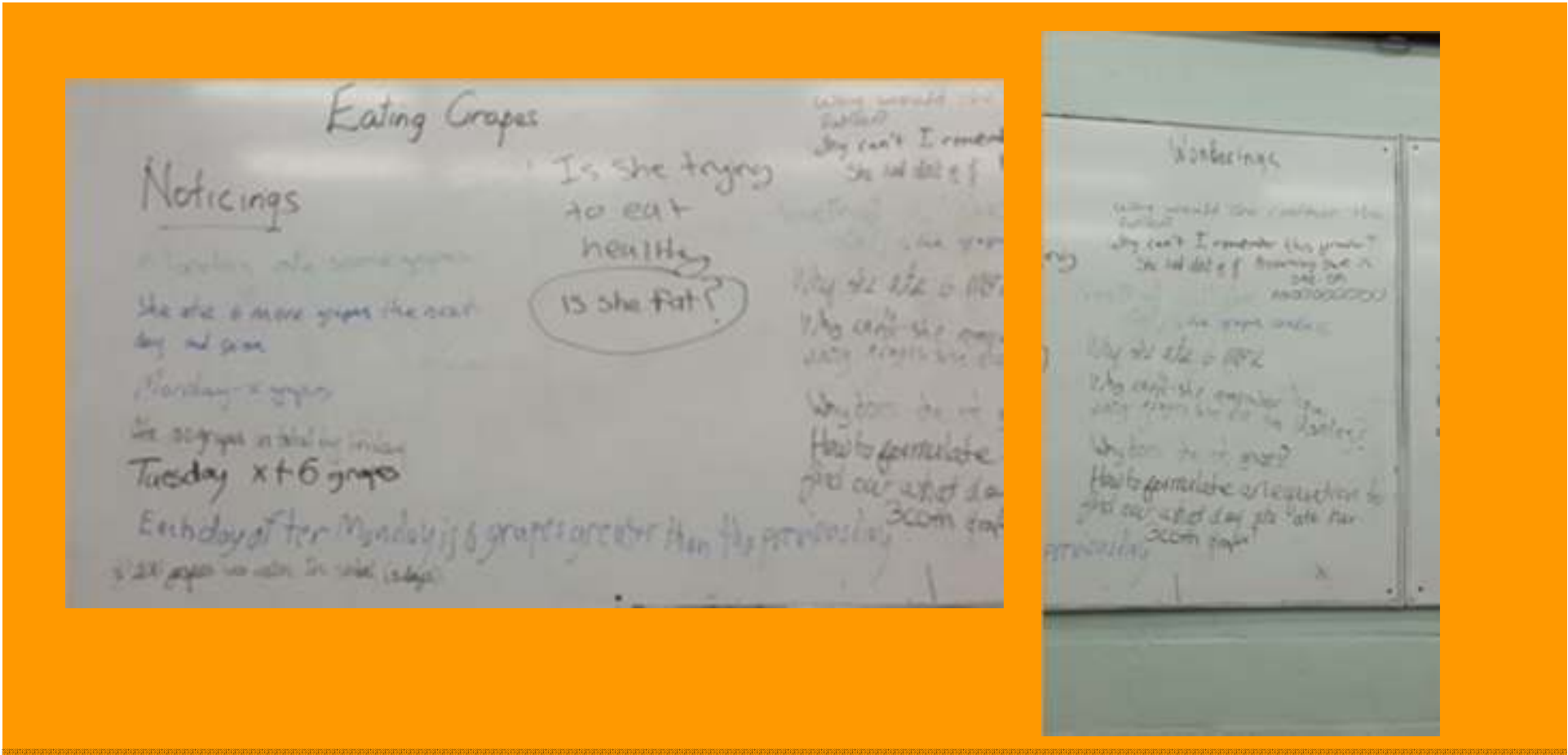
Scenario

How did we get started?

Reduce “risk” level

- Scenario
- “Notice and Wonder”





“Noticing and Wondering”

How did we get started?

Reduce “risk” level

- Scenario
- “Notice and Wonder”
- Groups in class





Leighton, Helen, Sage, Ellen

x $x+6$ $x+12$ $x+18$ $x+24$
 M T W Th F
 8 14 20 26 32 = 100

$5x + 60 = 100$
 $-60 \quad -60$
 $5x = 40$
 $x = 8$

$6 + 12 + 18 + 24 = 60$

Group Work in Class

How did we get started?

Reduce “risk” level

- Scenario
- “Notice and Wonder”
- Groups in class
- Partner mentoring



Peer mentoring

- In Class revision partners
- Online mentoring
 - Within and across classes
 - Across the miles



Final student submission

Answer:

I'm not sure I have found the final answer, but I understand the first two questions.

Explanation:

1. The mean of the dates in the four corners of the x is:
 $12+14+26+28 = 80/4 = 20$
20 is the mean of the four dates and the center

2. Another five dates that I chose on the calendar had the four corners: 10, 12, 24, and 26. $10+12+24+26 = 72/4 = 18$

I got the same result, the mean of the four corner center date of the x.

3. I am not sure exactly what this one is asking add the four corner dates up and find that mean the middle of the x. So if $d = 20$, then $20 = 12 +$
The mean of the four numbers equals the center

Memo:

Hi Annie

I like that you complimented her work and called her by name! When you

Explanation:

1) The mean of the dates in the four corners of the x is:

$$12+14+26+28 = 80/4 = 20$$

20 is the mean of the four dates and the center date of the x.

2) Another five dates that I chose on the calendar had the four corners: 10, 12,

24, and 26. $10+12+24+26 = 72/4 = 18$

I got the same result, the mean of the four corner dates was the same as the center date of the x. The x was 18, as was the mean of the four surrounding dates.

3) So d represents one of the five dates in the pattern. I still don't exactly understand this problem fully... I think that I could start with just having d. And then add 2 to it, like Annie suggested.

So it would look like: $d \quad d+2$ Because there is a two day space in the pattern, at least that's how it worked in the first two problems. I think when counting the days in between, I have to go back to d. So to get to the middle, the date that the mean adds up to, that would be 8 days, $d+8$

$$d \quad d+2 \\ d+8$$

Then I'll just try it again with the last two days. Starting from d again it would be $d+14$, then $d+16$ to get to the last day. I believe this result confirms that the mean of the four corner dates will always be equal to the center date.

Revised Peer mentor comments
Student's initial submission

Hey Addie, nice work!!! I really like how you explained it. When you revise you document the answer means for number three and three you should think about how the center two days after d would be $d+2$ so think about the great work!!!!!!

Peer mentor comments

How'd it go?

Status: SUBMITTED

Answer:

Trial and error was the only method that I could think of at the time.

Explanation:

Keeping in mind there are more parents than teachers. I eventually came to the conclusion.

$3 \times 22 = 66$
add
 $7 \times 6 = 42$
equal
108

Therefore there were at least for 4 parents and 2 teachers.

extra

If I was given the amount the teachers paid and the total amount the adults spent, and I would have been able solve the whole question.

Before Mentoring

How'd it go?

Explanation:

I know there are more parents (P), than teachers (T)

$P > T$

There are a total of 28 people including students (S) and adults going the the movie.

$$S + A = 28$$

The students 3 dollars a ticket and adults paid 7 dollars a ticket, and the total amount of money paid was 108 dollars.

$$(3 \times S) + (7 \times A) = 108$$

$$3S + 7A = 108$$

Therefore

$$A = 28 - S$$

Now I can substitute $28 - S$ for A in the money equation.

$$3S + 7(28 - s) = 108$$

$$3S + 196 - 7s = 108$$

$$-4S + 196 = 108$$

$$-4S = 108 - 196$$

$$-4S = -88$$

$$4S = 88$$

$$S = 88/4$$

$$S = 22$$

$$S = 22$$

Substitute $S = 22$ into the person equation

$$22 + A = 28$$

$$A = 28 - 22$$

$$A = 6$$

Therefore there were at least for 4 parents and 2 teachers.

For proof

$$22 + 6 = 28$$

And

$$(22 \times 3) + (6 \times 7) = 108$$

extra

If I was given the amount the teachers paid and the total amount the adults spent, and I would have been able solve the whole question.

After Mentoring

What did we notice after mentoring?

- Students were more likely to provide in-depth explanations of their work.
- Students mentioned their thinking - what worked and what didn't - more often.
- Students used more math vocabulary more appropriately in their explanations.
- Students checked their solutions more often.
- Students often checked those solutions using alternate strategies.
- Students were more likely to revise their solutions.

What did the students notice?

- Tell me about a problem or a part of a problem you liked solving and why.

“I really enjoyed the my three dogs POW. I liked how we got to go with a partner and reflect.”

“One of the problems I liked most was the “eating grapes” question. The first part of the question I liked working out because it required thinking and focus. The use of making up an equation to find the answer help your creativity and math skills to analyze and determine the answer.”

What did the students notice?

- Tell me about a problem that you thought was challenging, what made it challenging?

“None of the problems were that challenging to me, but what was a little difficult was breaking down the answers so that someone else could understand the steps that were taken.”

“The function problem was challenging because I didn't know how to do it. I guessed and checked until I worked with someone else.”

“The function problem was most challenging for me. Problems that include lots of steps are usually hard for me to start because I can be unsure of where to begin. “

What did the students notice?

- How do you think it helps you to write about how you solved a problem or the work you've done on a problem even if you have not solved it?

“When you write about something you can open up your mind and explore other ways of solving. It forces you to think about your work differently, resulting in an expanded knowledge of something.”

“It helps by forcing you to write it out because you have to know what you're doing to write down what part of the step you are doing forcing you to find your points of confusion. ”

What did the students notice?

- What did you learn about your own thinking and learning through the mentoring process?

“I learned that when I need help with a problem I don't necessarily need the answer but be guided to the answer. ”

“The mentoring process helped show me that the thought process is just as important as finding the solution to the problem.”

How can you get started?

- www.mathforum.org
- Practice with small groups in class.
- Move on to revision partners.
- Recruit another teacher to work with you!
- Contact us!



Contact us!

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