



Numberless Word Problems

Creating a Culture of Sense Making



ROUND ROCK
INDEPENDENT SCHOOL DISTRICT

Brian Bushart
Elementary Mathematics Curriculum Coordinator

AGENDA

- Prologue
- Margie's Story
- Anna and Loretta's Story
- Putting It All Together
- Taking It Back to the Classroom



<https://bit.ly/NCTM2018NWP>



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PROLOGUE



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\$35.97

Notice anything similar?

Jana bought 1 hat and 2 skirts. The hat cost \$28.53, and the skirts cost \$15.88 each. What is the total cost in dollars and cents of the items Jana bought?

4th Grade, Texas STAAR, 2016

6th most difficult item out of 48 items



Item difficulty

Jana bought 1 hat and 2 skirts. The hat cost \$28.53, and the skirts cost \$15.88 each. What is the total cost in dollars and cents of the items Jana bought?

4th Grade, Texas STAAR, 2016

51% - correct or reasonably close

33% - 1 hat and 1 skirt \approx 1,200 children





WHAT'S GOING ON?



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Culture of Answer Getting

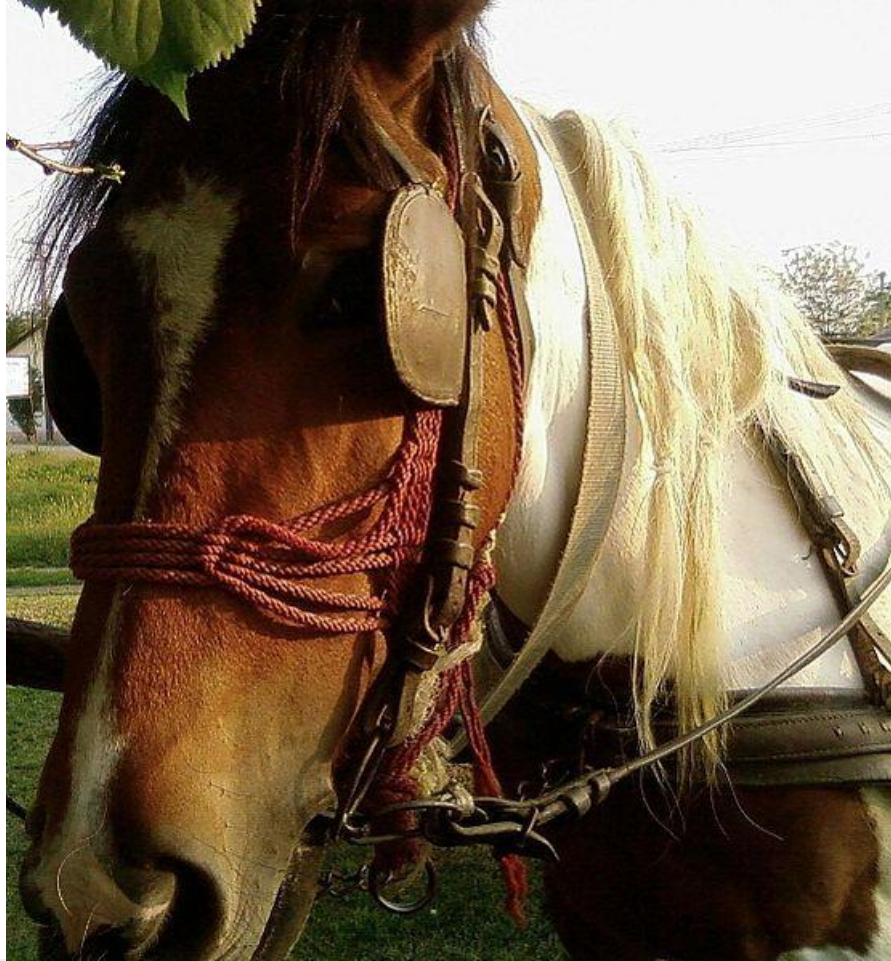
- Blinders on
- Crowding out
- Gaps in understanding



Culture of Answer Getting

- **Blinders on**
- Crowding out
- Gaps in understanding





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Blinders on

Jana bought 1 hat and 2 skirts. The hat cost \$28.53, and the skirts cost \$15.88 each. What is the total cost in dollars and cents of the items Jana bought?




What's going on?

- Blinders on
- **Crowding out**
- Gaps in understanding



Crowding out

Can my thinking go here?



Name: _____

1 The Capital Area Dog Show judged dogs in 8 groups. There were 3 winners in each group. Each winner received a trophy that cost \$4. What was the total cost, in dollars, of all the trophies?

2 Before leaving on a trip, several Girl Scout troops were meeting at the mall to carpool. Each car will hold 6 people. If there were 85 people going on the trip, what is the least number of cars needed so that everyone has a ride?

3 There were a total of 48 contestants in a scavenger hunt. The contestants were separated into 4 equal teams. Which diagram below correctly models this situation?

4 Sarah's mom made 40 cookies for Sarah's pool party. There are 9 children at the party including Sarah. Sarah's father gave her \$20 for decorations. If each child ate the same number of whole cookies, how many whole cookies did each child eat?

5 Devin is reading a book that has 50 pages. He has nine days to finish the book. Which is closest to the number of pages Devin must read each day in order to finish the book on time?

6 The diagram shows the number of marbles different students collected. What is the total number of marbles collected by the students who had 26 marbles?

A 91 cars
B 14 cars
C 15 cars
D 7 cars

A 30 pages
B 40 pages
C 50 pages
D 60 pages

A

?			
48			4

B

48			
4			?


C

?			
48	48	48	48

D

48			
?			

Number of Marbles



176

Shooting STAARS Grade 4

© 2017 Shooting STAARS

And this is only page 1!



Crowding out

Hector earns \$11.75 per hour for mowing lawns. The table shows the numbers of hours he mowed lawns last week. Use the table for questions 8 and 9.

Day	Hours
Mon	8
Tues	4.5
Thurs	7
Fri	2

8 What was Hector's gross income for the week?

F \$292.50
G \$293.75
H \$305.50
J \$317.25

9 Hector's employer withholds 8% of his wages for payroll taxes. Which of the following is the take-home pay for how much he earned last week?

A \$60
B \$24
C \$275
D \$285

10 Which of the following represents a fund?

Vadym's Monthly Budget

Vadym's Monthly Budget	
Rent	\$850
Car Payment	\$205
Insurance	\$175
Utilities	\$95
Food	\$95
Clothing	\$225
College Loan Payment	\$100
Emergency Savings	\$100

11 What is the minimum amount of take-home pay Vadym must earn each month to meet his budget?

A \$2,815
B \$2,005
C \$1,995
D \$1,985

12 Vadym currently earns a net income of \$950 per paycheck. There are 2 pay periods per month. He hopes to get a raise at work. What is the minimum additional amount Vadym would need to earn per pay period to meet his monthly budget?

F \$28
G \$55
H \$57.50
J \$115



What's going on?

- Blinders on
- Crowding out
- **Gaps in understanding**



Gaps in understanding



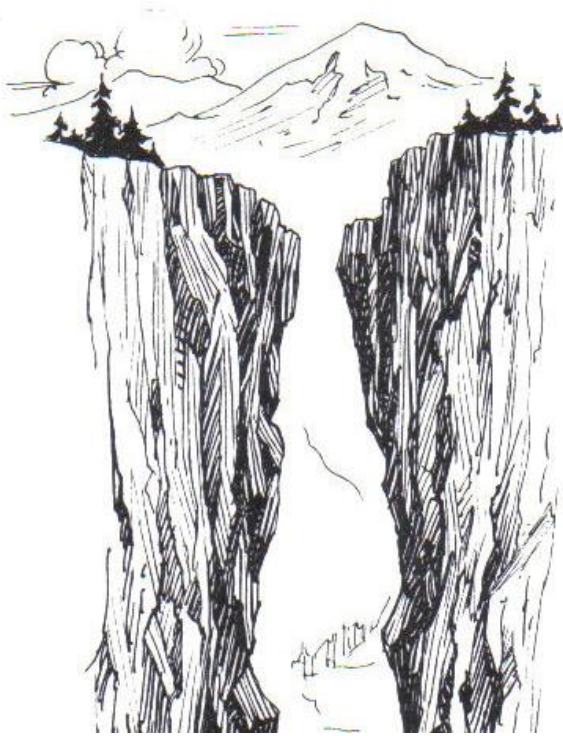
Jana bought 1 hat and 2 skirts. The hat cost \$28.53, and the skirts cost \$15.88 each. What is the total cost in dollars and cents of the items Jana bought?

4th Grade, Texas STAAR, 2016



Gaps in understanding

Jana bought 1 hat
and 2 skirts.



The hat cost
\$28.53, and the
skirts cost \$15.88
each.



Gaps in understanding



Jana bought 1 hat and 2 skirts. The hat cost \$28.53, and the skirts cost \$15.88 each. What is the total cost in dollars and cents of the items Jana bought?



Culture of Answer Getting

- Blinders on
- Crowding out
- Gaps in understanding



Answers matter, but we want more than just correct answers.





WHAT NEEDS TO CHANGE?



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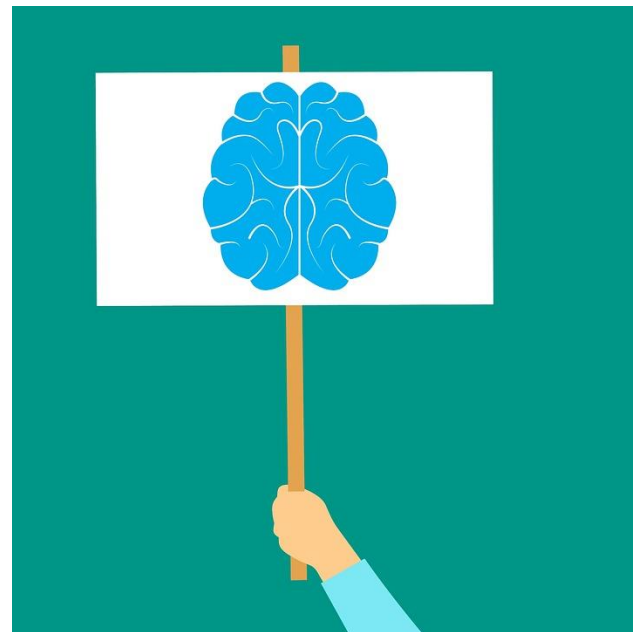
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Culture of Sense Making

- Take the blinders off
- Provide space and time to think
- Bridge gaps in understanding



Culture of Sense Making

- Take the blinders off
- Provide space and time to think
- Bridge gaps in understanding

Numberless Word Problems





MARGIE'S STORY



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Margie naively brought two bags of grading with her to NCTM.

- She had some in-class assignments in the first bag.
- She had some homework assignments in the second bag.



Margie naively brought two bags of grading with her to NCTM.

- She had 37 in-class assignments in the first bag.
- She had 56 homework assignments in the second bag.



Margie naively brought two bags of grading with her to NCTM.

- She had 37 in-class assignments in the first bag.
- She had 56 homework assignments in the second bag.
- She graded some of the in-class assignments on the plane to D.C.



Margie naively brought two bags of grading with her to NCTM.

- She had 37 in-class assignments in the first bag.
- She had 56 homework assignments in the second bag.
- She graded 28 of the in-class assignments on the plane to D.C.
- How many in-class assignments does she have left to grade?
- How many assignments does she have left to grade?
- How many more homework than in-class assignments does she have left to grade?



Margie naively brought two bags of grading with her to NCTM.

- She had 37 in-class assignments in the first bag.
- She had 56 homework assignments in the second bag.
- She graded 28 of the in-class assignments on the plane to D.C.

Write a number sentence that can be used to find how many assignments Margie has left to grade in the two bags.



Rita had two boxes of ribbons.

- She had 37 large ribbons in the first box.
- She had 56 small ribbons in the second box.
- She gave 28 of the large ribbons to her sister.

Which number sentence can be used to find the number of ribbons Rita had left in the two boxes?

F $56 + 28 + 37 = \square$

H $37 + 28 - 56 = \square$

G $37 - 28 + 56 = \square$

J $56 + 28 - 37 = \square$



3rd Grade, Texas STAAR, 2016



Features of Numberless Word Problems

- Reveal information over time
- Situation first, question last
- Reason about relationships and quantities along the way





ANNA AND LORETTA'S STORY



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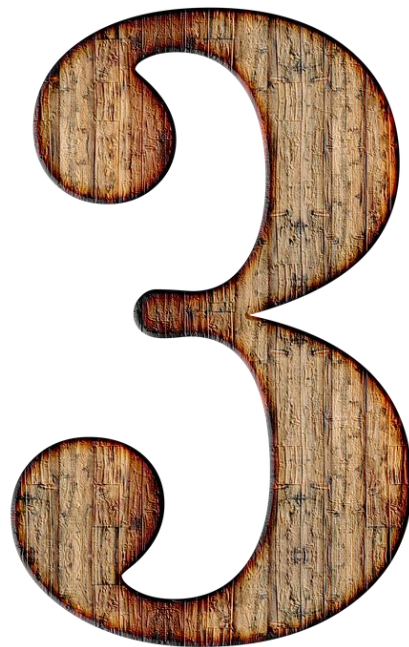
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Setting the Scene



Setting the Scene

- Students have struggled with word problems, especially choosing the correct operation.



Setting the Scene

- Students were lowest performing on EOY math assessment
- Students were second to lowest on EOY reading assessment



Creating a Community of Sense Making

- Coaching cycle focusing on Numberless Word Problems (Jan – Apr)
- Start by collecting pre-assessment data

Name: _____

Janis collected cans three times last year.

- In February she collected 382 cans.
- In April she collected 475 cans.
- In June she collect 629 cans.

How many more cans did Janis collect in February and April combined than she collected in June?

The Union Hill cafeteria sold 273 lunches on Monday. They sold 442 lunches on Friday. What is the difference between the number of meals the cafeteria sold on the two days?



Features of Numberless Word Problems

- Reveal information over time
- Situation first, question last
- Reason about relationships and quantities along the way



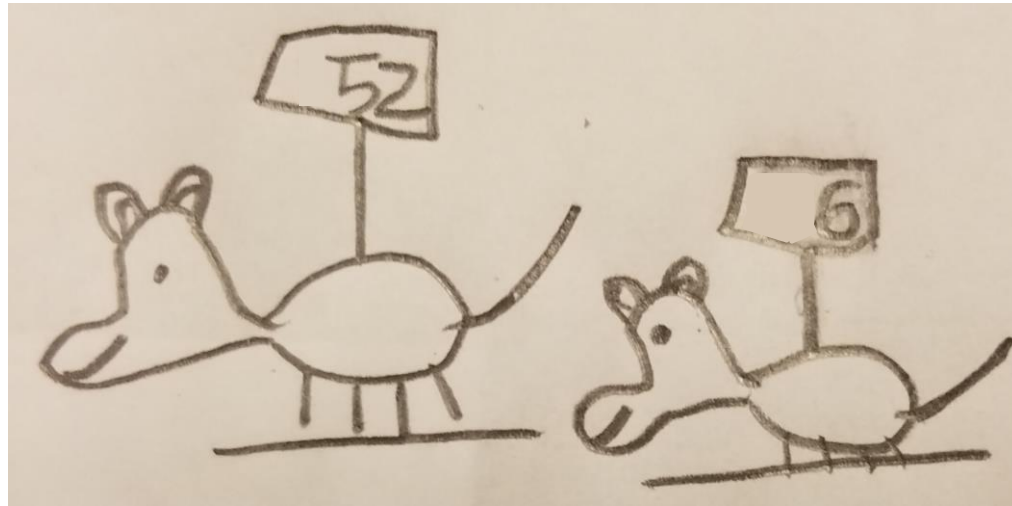
A Chihuahua weighs some number of pounds. A collie weighs some number of pounds.



A Chihuahua weighs 6 of pounds. A collie weighs
some number of pounds.



A Chihuahua weighs 6 of pounds. A collie weighs 52 pounds.



A Chihuahua weighs 6 of pounds. A collie weighs 52 pounds.

How many Chihuahuas will it take to equal the weight of the collie?



A Chihuahua weighs 6 of pounds. A collie weighs 52 pounds. How much heavier is the collie than the Chihuahua?

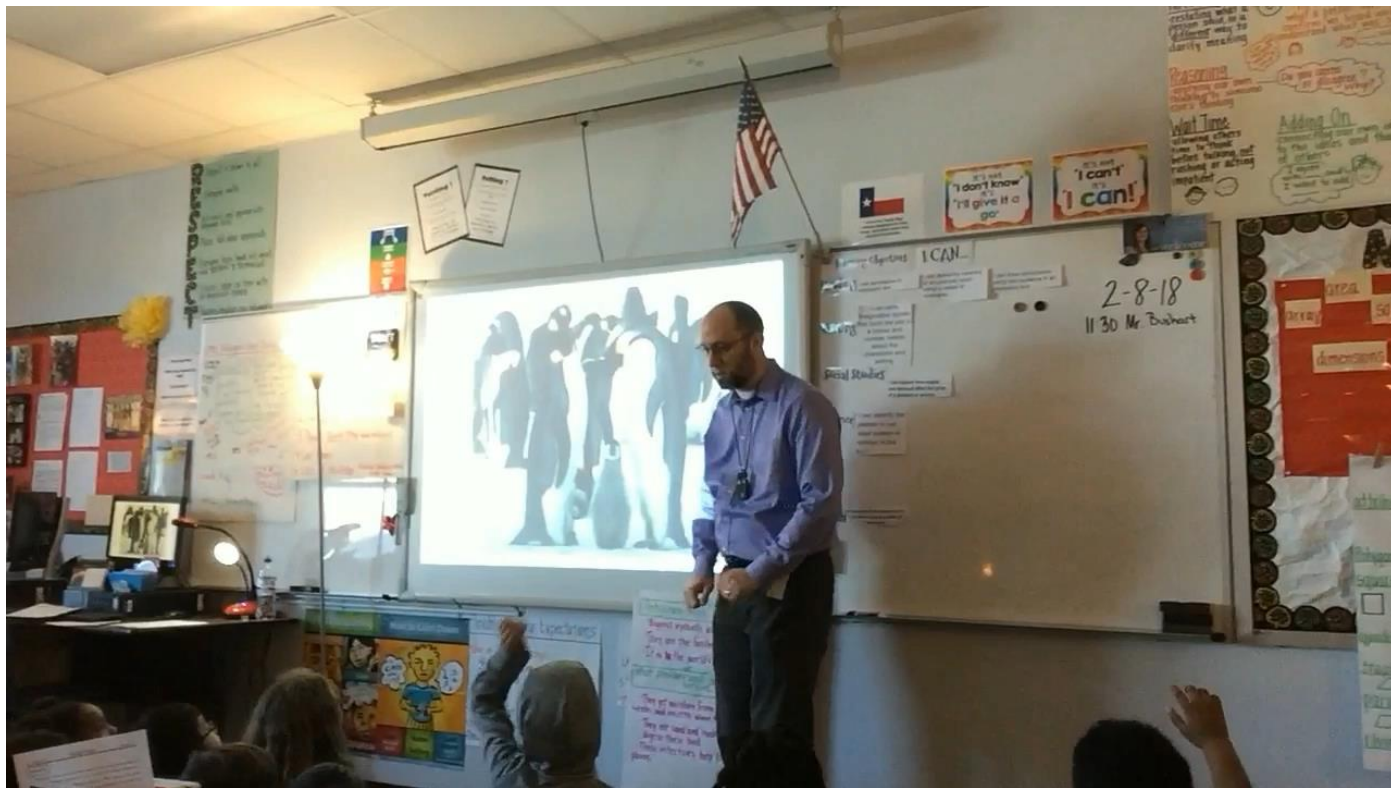


Creating a Community of Sense Making



Scientists recently unearthed the fossil of an ancient penguin that was as tall as an adult man!





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Creating a Community of Sense Making

Scientists recently unearthed the fossil of an ancient penguin that was as tall as an adult man! The largest penguin alive today is the emperor penguin. It is only as tall as a 5-year-old boy and weighs 88 pounds. This is 132 pounds less than the ancient penguin. How much did the ancient penguin weigh?



Creating a Community of Sense Making

PLC

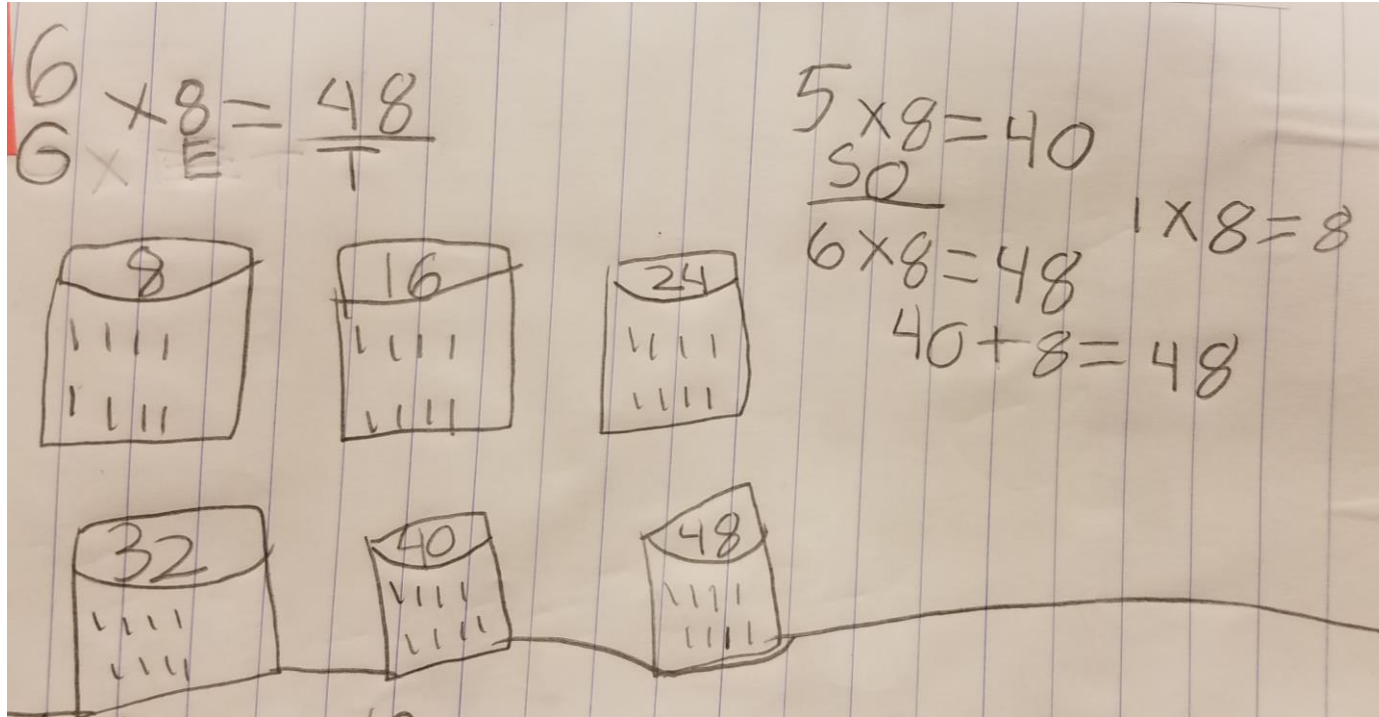


Creating a Community of Sense Making

Max and his dad were creating a giant sand castle. They filled up 6 buckets of sand to use. Each bucket held 8 pounds of sand. How many pounds of sand did they use?



Creating a Community of Sense Making



Creating a Community of Sense Making



Creating a Community of Sense Making

Joseph loves Minecraft. He is working on building a larger wheat farm. One section of his wheat farm has 4 equal rows of 6 plants. Another section has 68 plants.



Creating a Community of Sense Making

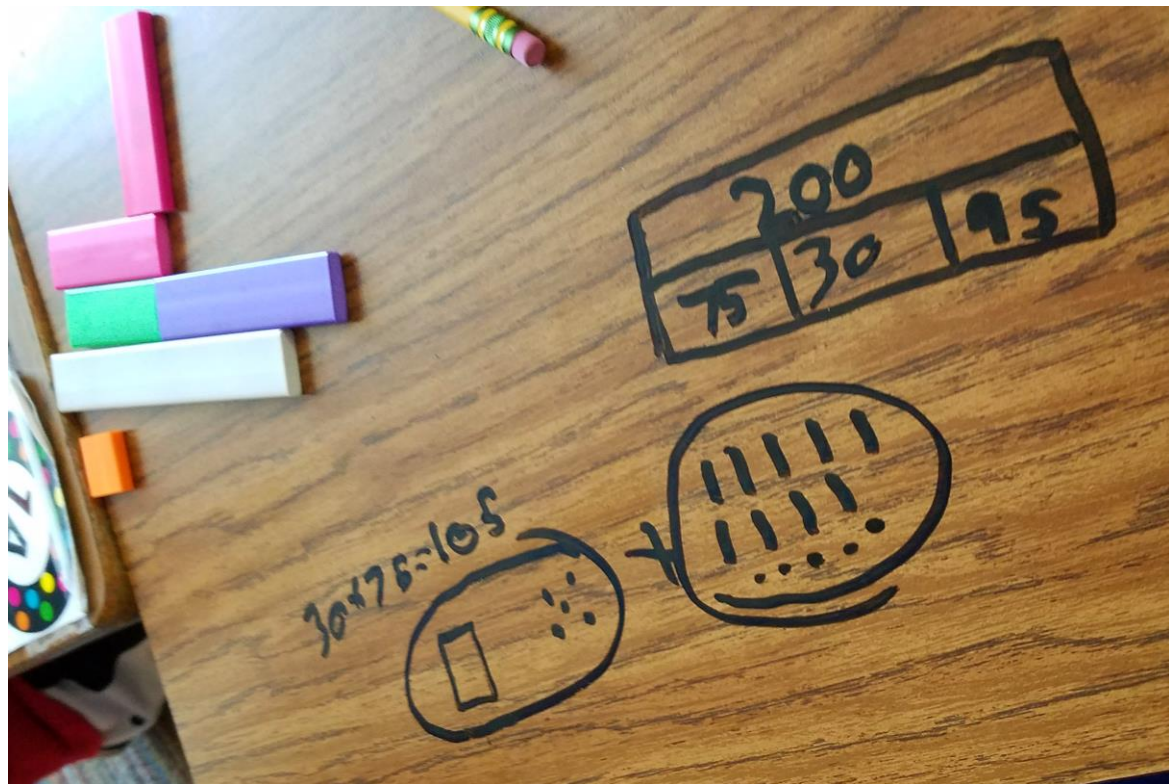
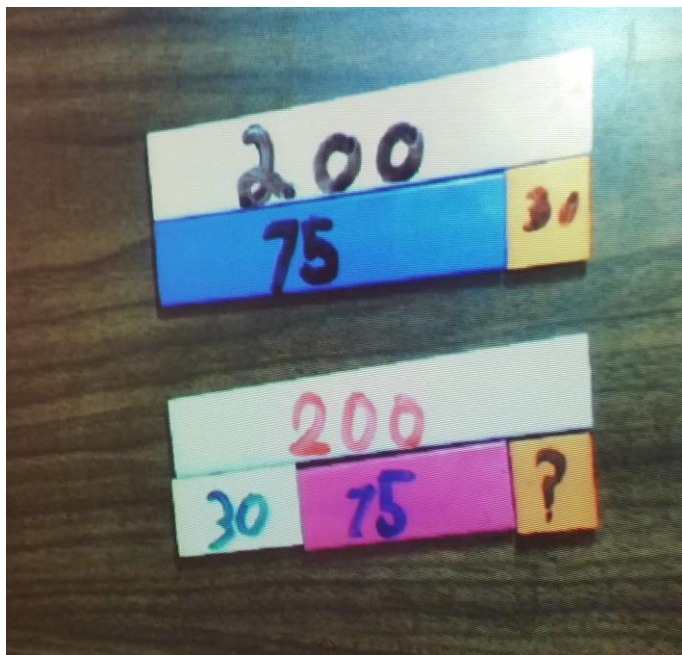


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Estrella's goal is to practice her piano for 200 minutes this week.

- On Monday she practiced for 30 minutes.
- On Wednesday she practiced for 75 minutes.



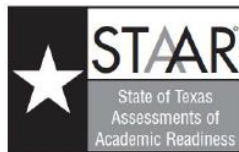


Creating a Community of Sense Making



**STAAR Ready
Assessment
Mathematics**

**GRADE 3
Spring 2018**



Released Test - Administered May 2017

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- Analyzed assessment data to provide focused support



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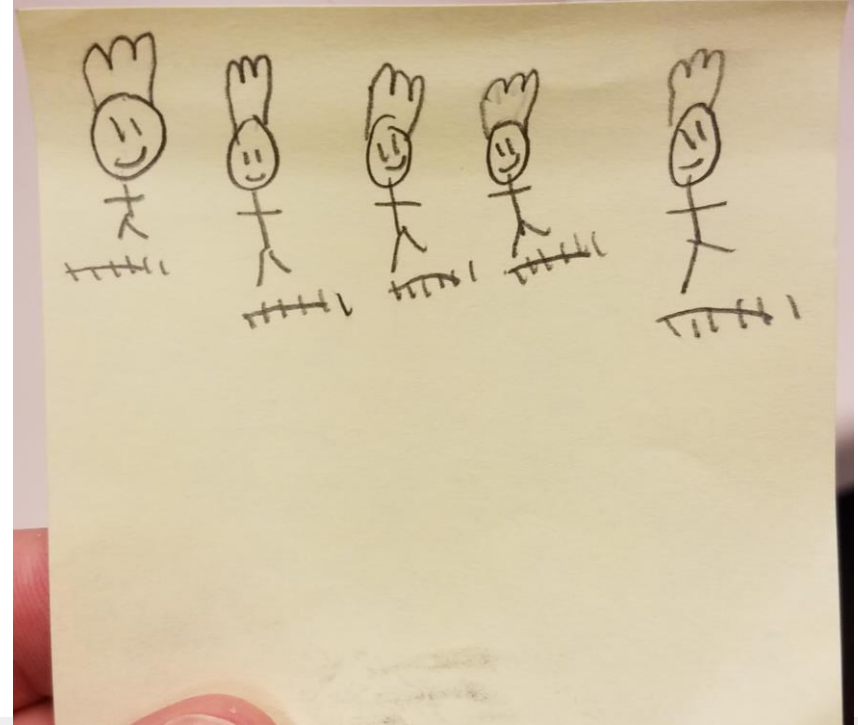
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Creating a Community of Sense Making

Five bakers each made 6 pies. Each pie had 5 slices. Which equation shows one way to find the total number of slices?



Using Numberless Word Problems

- Respond to students' needs
- Intentional planning over time
- Value sense making, not just answer getting



Anna's Feedback

Numberless word problems have been a success in my classroom. The students are making more sense of problems and are able to discuss their thinking **WAY** more than in the beginning.

They love to notice and wonder, and I feel like NWP have made them slow down, think about, and process operations more than before.

-- Anna Trolinger



Anna's Advice

- Highlight just a few noticings and wonderings to save time
- Ask, “What would a mathematician notice or wonder?”
- Avoid “fluff” images on the story slides
- Have students sketch their visualizations on sticky notes
(Great formative assessment!)





PUTTING IT ALL TOGETHER



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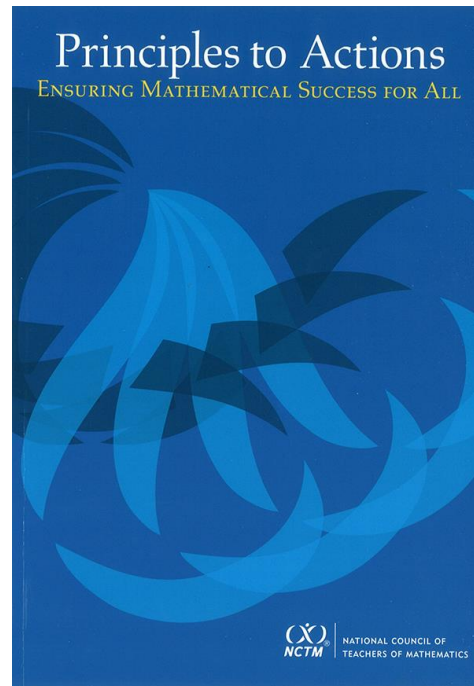
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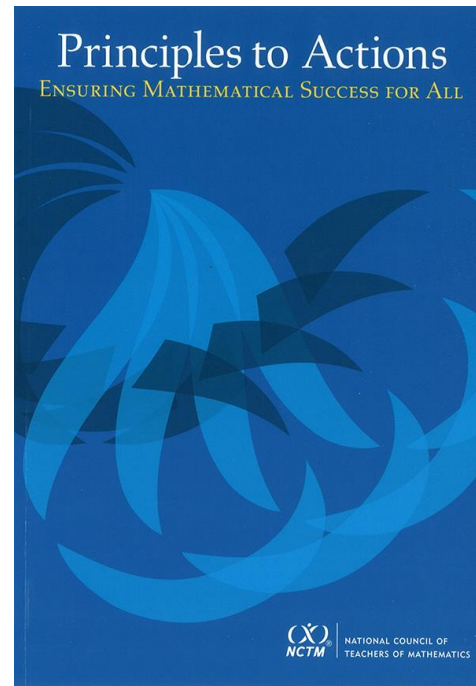
Effective Mathematics Teaching Practices

- Facilitate meaningful mathematical discourse
- Pose purposeful questions



Effective Mathematics Teaching Practices

- Implement tasks that promote reasoning and problem solving
- Use and connect mathematical representations



Students Who Struggle

“Simple word problems give meaning to mathematical operations such as subtraction or multiplication. When students are taught the underlying structure of a word problem, they not only have greater success in problem solving but can also gain insight into the deeper mathematical ideas in word problems.”

--IES Practice Guide “Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools”



Students With Disabilities

“The reliance on key words and procedures often leads to a dependency on adults for help, the learned helplessness that can become a habit for students with learning disabilities...They do not develop a sense of personal agency or confidence that they can learn.”

--Judy Storeygard, Count Me In! Including Learners with Special Needs in Mathematics Classrooms, page 98



Emergent Bilingual Students

“Strategies that promote student discourse offer teachers one way to support their students’ sense-making processes. Further, when embedded into teachers’ daily mathematics instruction, strategies that promote mathematics discourse allow teachers to monitor the ways in which students are making sense of information.”

--Lara Dick, et al, “Supporting Sense Making with Mathematical Bet Lines”,
Teaching Children’s Mathematics, May 2016



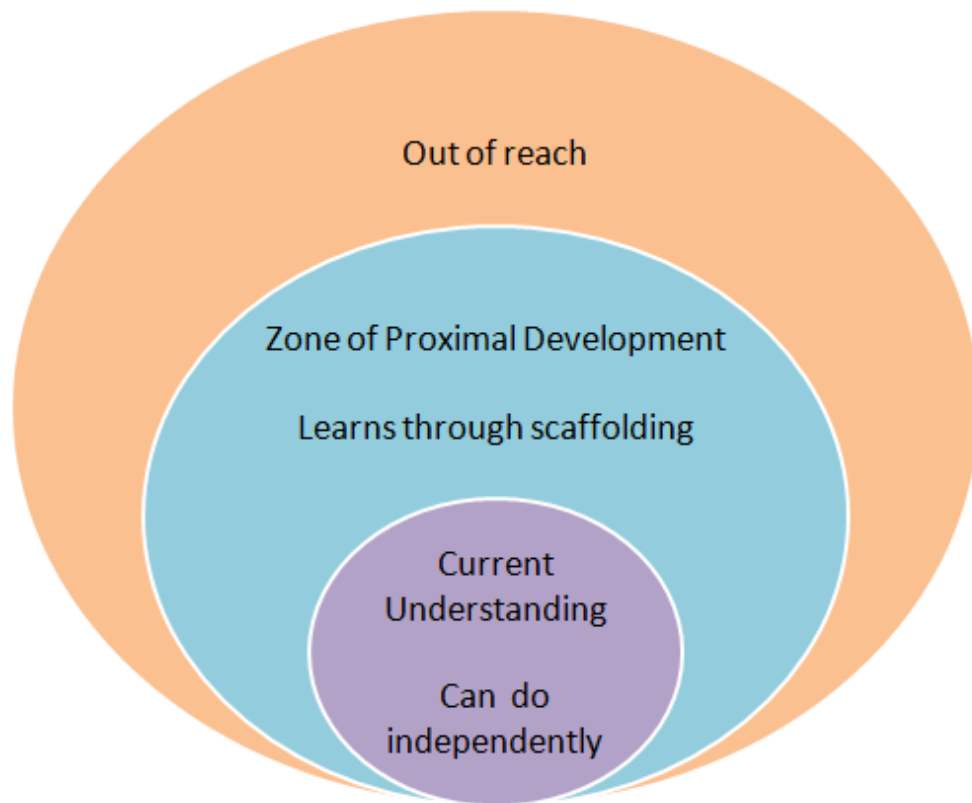
Supporting Each and Every Learner

*“What if we turn math into literacy?...Here are characteristics of strong readers. It doesn’t take much to change this into characteristics of strong mathematicians...Stop cracking the math code already! **Make sense making a focus of every single thing you do in your math classroom.**”*

--Annie Fetter, “Sense Making: It Isn’t Just for Literacy Anymore”, 2015 NCTM Annual Conference



Scaffolding



Scaffolding



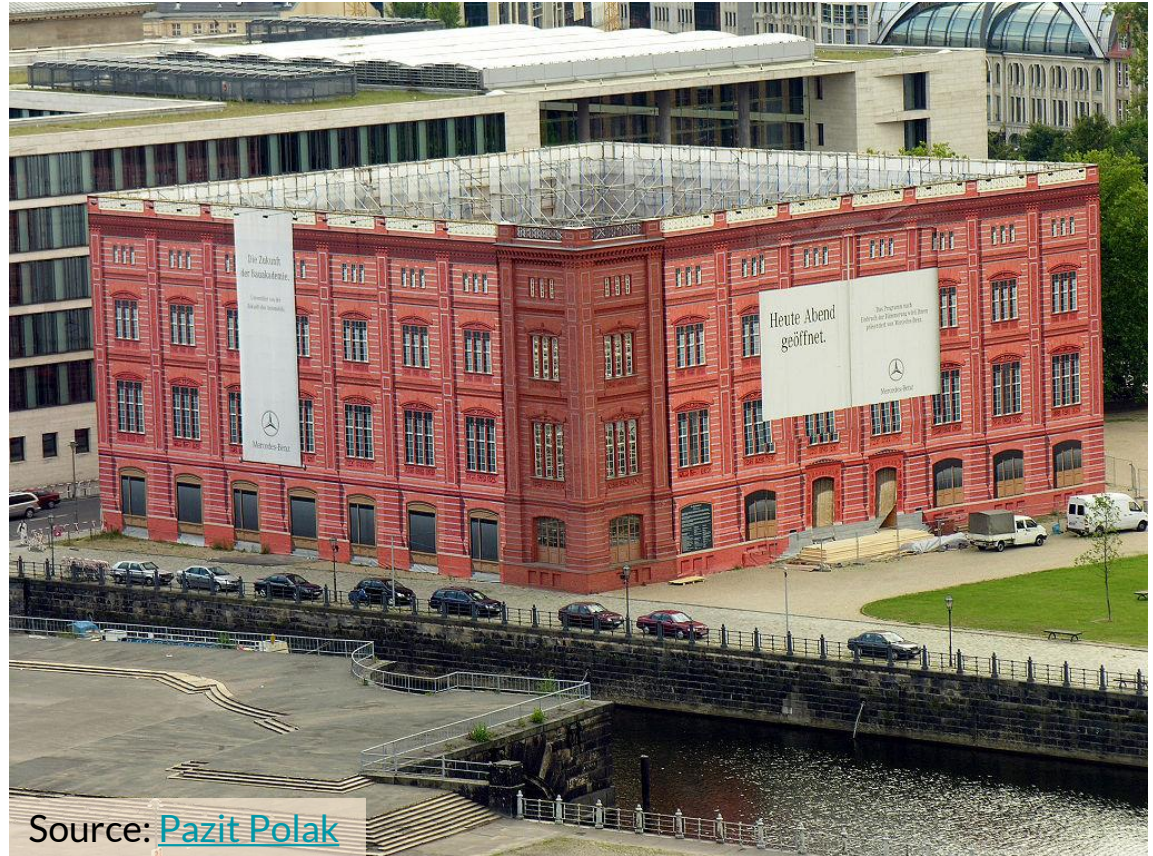
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Scaffolding



Source: [Pazit Polak](#)



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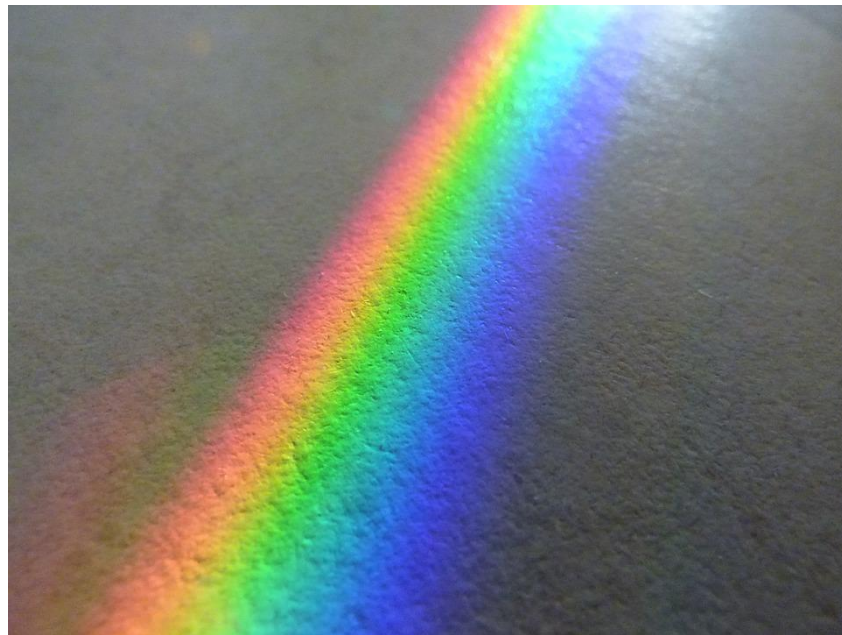


Source: [Dr. Karl-Heinz Hochhaus](#)

Spectrum of Support

- Numberless Word Problems
- 3 Reads
- Removing the Question
- Notice and Wonder

<https://bit.ly/3ReadsSite>



TAKING IT BACK TO THE CLASSROOM

Evan checks out some books from the library.
He reads and returns some of the books.

ain Growers



Strong Readers
READ EVERYDAY
Monday ✓ Thursday ✓
Tuesday ✓ Friday ✓
Wednesday ✓ Saturday ✓

HEB McDonald's
Readers read EVERYTHING they see

Strong Readers
I care of books
I use the book to read

Strong Readers
I read the pictures
I read the words

Strong Readers
1. Read
2. Think
3. Talk about books!

Strong Readers
Read from the left
Read from the right
Read from the middle



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Start Here - <https://bit.ly/NumberlessWP>

Teaching to the Beat of a Different Drummer

My place to write about teaching, and math, and teaching math.

[HOME](#)[ABOUT](#)[CONFERENCES & WORKSHOPS](#)[PROFESSIONAL DEVELOPMENT](#)[#SHADOWCON16](#)[NUMBERLESS WORD PROBLEMS](#)[FRACTION RESOURCES](#)[TALKING MATH WITH KIDS](#)[#ELEMATHCHAT](#)

Numberless Word Problems

Have you ever said or thought any of the following?

Search



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Anna's Numberless Word Problems

<https://bit.ly/AnnaNWP>

[The Collie and Chihuahua Problem](#) – This is a comparison problem where the difference is unknown.

[The Ancient Penguin Problem](#) – This is another comparison problem. This time the larger quantity is unknown.

[The Sand Castle Problem](#) – This is an equal groups problem with an unknown product.

[The Minecraft Problem](#) – This is a multi-step problem involving multiplication and addition.

[The Piano Practice Problem](#) – This is a multi-step problem involving addition and subtraction.

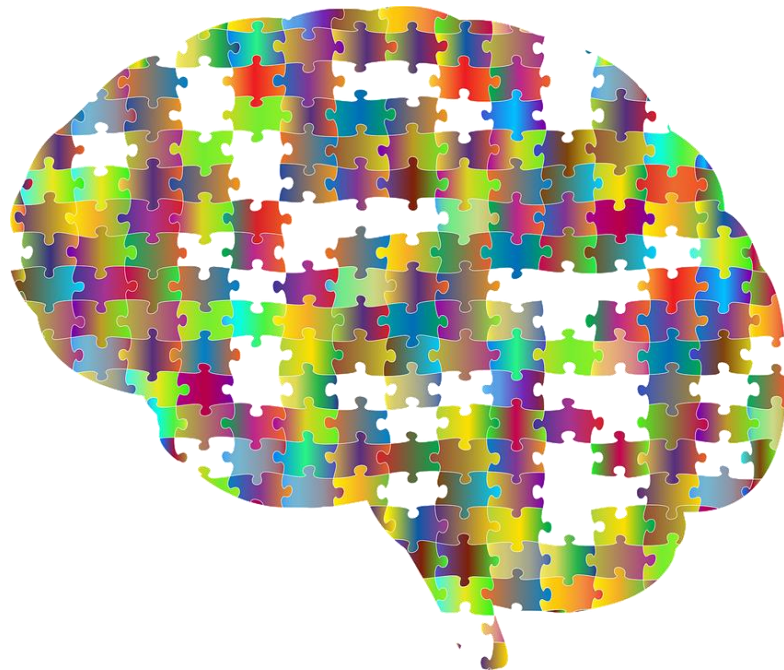
[The Pie Problem](#) – This is a multi-step problem involving multiplication.



Focus on Sense Making

“Take it in short chunks.
Don't get too bogged down
in worrying about the
‘answer’. Get excited about
watching the process.”

-- Christine Mauer, Special
Education K-5, Texas



Pose Purposeful Questions

“When I was first starting to use NWP, I printed out the slide presenter's notes to help me get used to the structure of the questions.”

-- Jenna Laib, K-8 Math Specialist,
Massachusetts

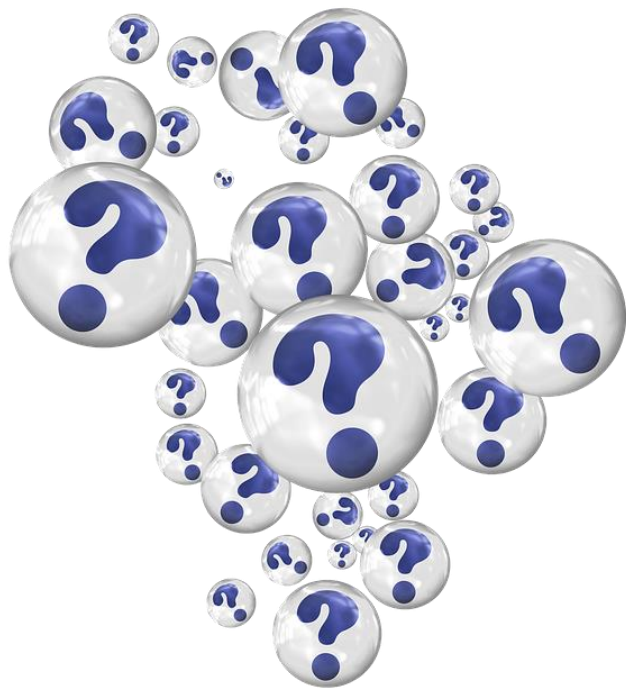


Pose Purposeful Questions

- What are you picturing in your mind?
- What changed? What do you know now that you didn't know before?
- What number do you think would make sense here? Why do you say that?
- What questions could we ask about this situation?



Student-Generated Questions



**“They can complicate it
more than I ever would.”**

--Leilani Losli, Instructional Coach,
Round Rock ISD

<https://bit.ly/LosliNWP>



Student-Generated Numbers



“When I told them I was not giving them the information and that instead they were choosing their own numbers along with the question they wanted to answer, they were so excited!”

<https://bit.ly/MathMindsNWP>

-- Kristin Gray, PD Designer, Delaware



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NWP in Small Groups

Mrs. Prentice shipped pints of ice cream to stores on Monday. She shipped three flavors of ice cream.

1

Mrs. Prentice shipped pints of ice cream to stores on Monday.

- She shipped some pints of chocolate ice cream.
- She shipped some pints of strawberry ice cream.
- She shipped some pints of vanilla ice cream.

2

Mrs. Prentice shipped pints of ice cream to stores on Monday.

- She shipped 375 pints of chocolate ice cream.
- She shipped some pints of strawberry ice cream.
- She shipped some pints of vanilla ice cream.

3

Mrs. Prentice shipped pints of ice cream to stores on Monday.

- She shipped 375 pints of chocolate ice cream.
- She shipped 143 pints of strawberry ice cream.
- She shipped some pints of vanilla ice cream.

4

Mrs. Prentice shipped pints of ice cream to stores on Monday.

- She shipped 375 pints of chocolate ice cream.
- She shipped 143 pints of strawberry ice cream.
- She shipped 137 pints of vanilla ice cream.

5

Jennifer Houghton,
Elementary Math
Specialist, Texas

So what question could I ask you about this situation?

6

How many pints of ice cream did she ship altogether?

7

How many fewer pints of vanilla ice cream did she ship than chocolate?

8

How many more pints of chocolate ice cream did she ship than pints of strawberry and vanilla combined?

9

Next Monday she ships 30 less pints of chocolate ice cream. How many pints of chocolate ice cream does she ship next Monday?

10





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Bar Models

Mrs. Prentice shipped pints of ice cream to stores on Monday.

- She shipped 375 pints of chocolate ice cream.
- She shipped 143 pints of strawberry ice cream.
- She shipped 137 pints of vanilla ice cream.

How many more pints of chocolate ice cream did she ship than pints of strawberry and vanilla combined?



The bar model shows a brown bar for 375, a pink bar for 143, and a yellow bar for 137, with a small orange bar for 95. The handwritten calculations are:


$$\begin{array}{r} 143 \\ + 137 \\ \hline 280 \end{array}$$

$$\begin{array}{r} 375 \\ - 280 \\ \hline 095 \end{array}$$

Mrs. Prentice shipped pints of ice cream to stores on Monday.

- She shipped 375 pints of chocolate ice cream.
- She shipped 143 pints of strawberry ice cream.
- She shipped 137 pints of vanilla ice cream.

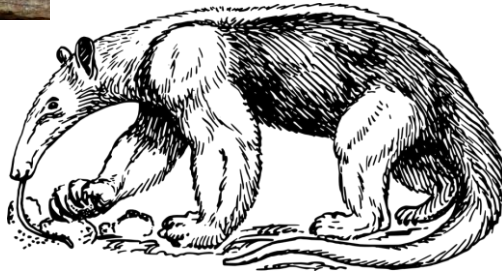
How many fewer pints of vanilla ice cream did she ship than ~~strawberry and vanilla combined?~~ ^{chocolate ice cream}?



The bar model shows a brown bar for 375, a yellow bar for 137, and a purple bar for 238. The handwritten calculations are:

$$\begin{array}{r} 375 \\ - 137 \\ \hline 238 \end{array}$$


Storytelling



Fun Facts:

- An anteater's tongue is long and skinny, like a piece of spaghetti.
- An anteater's tongue is about 2 feet long.

Jana Byrd, Alabama Math Science and Technology Initiative



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Storytelling

Scientists recently unearthed the fossil of an ancient penguin that was as tall as an adult man! The largest penguin alive today is the emperor penguin. It is only as tall as a 5-year-old boy and weighs 88 pounds. This is 132 pounds less than the ancient penguin. How much did the ancient penguin weigh?



Storytelling

Scientists recently unearthed the fossil of an ancient penguin that was as tall as an adult man!

Scientists recently unearthed the fossil of an ancient penguin that was as tall as an adult man! The largest penguin alive today is the emperor penguin. It is only as tall as a 5-year-old boy and weighs 88 pounds.

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Storytelling



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Storytelling

pixabay

You Tube



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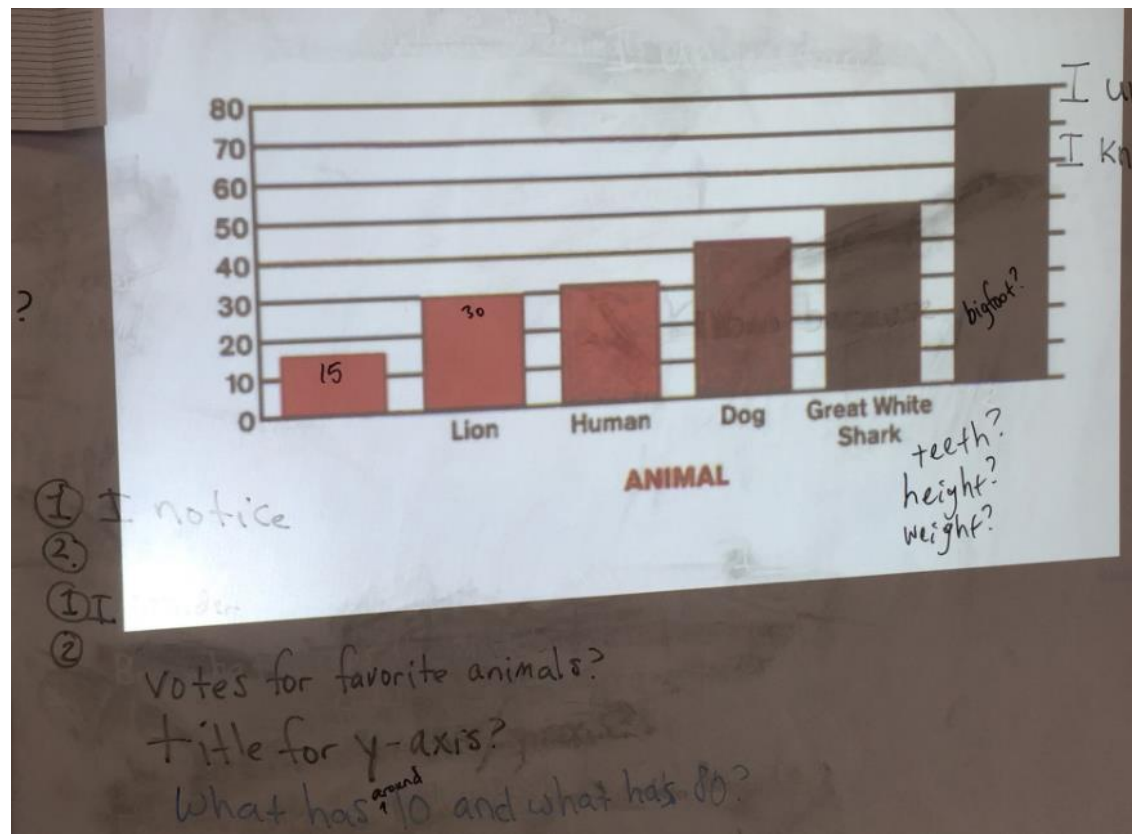
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Storytelling

Heidi Fessenden,
Teacher,
Massachusetts

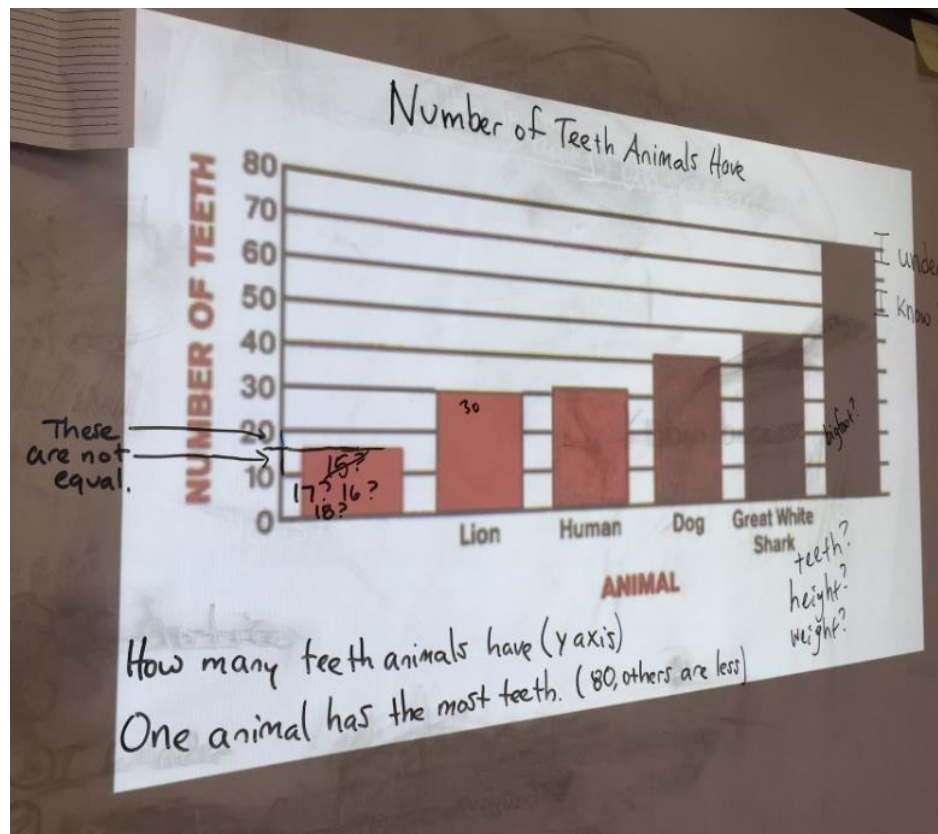
Kassia Wedekind,
Math Coach, Virginia



Storytelling

Heidi Fessenden,
Teacher,
Massachusetts

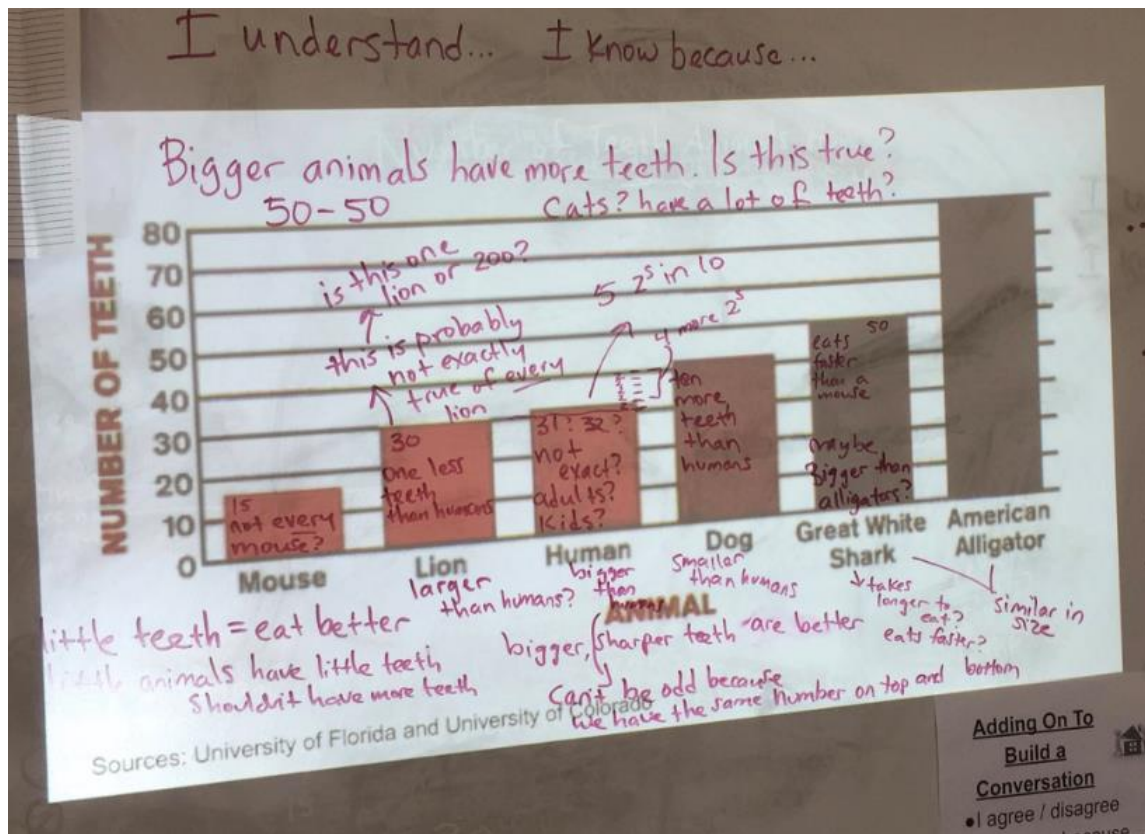
Kassia Wedekind,
Math Coach, Virginia



Storytelling

Heidi Fessenden,
Teacher,
Massachusetts

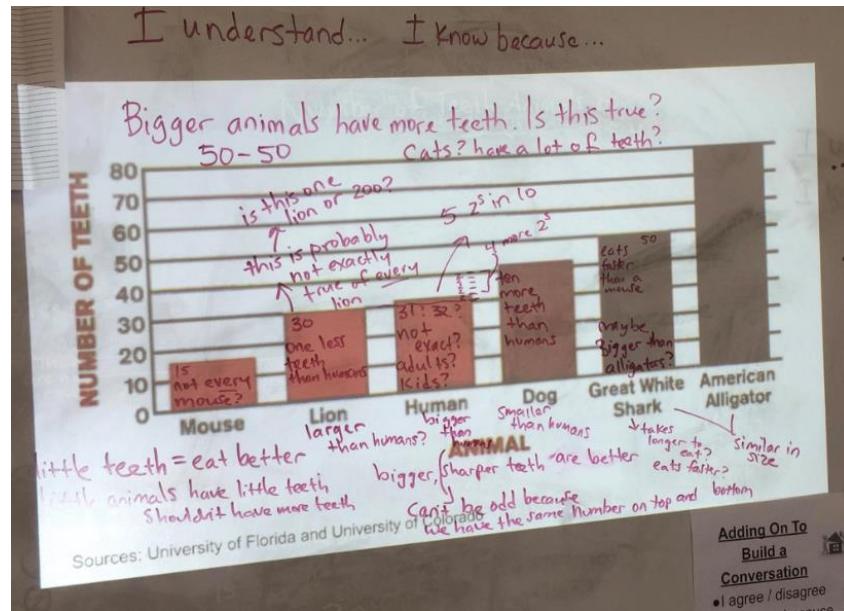
Kassia Wedekind,
Math Coach, Virginia



Storytelling

“Is this graph about ONE lion, ONE shark, or MANY lions, MANY sharks? Also, does a human have 31 or 32 teeth? How do we know?”

-- Heidi Fessenden, Teacher,
Massachusetts



“Just try it! It might not go exactly as planned, but it’s worth the risk.”

-- Julie Bourke, Michigan, 2nd grade teacher





IN CLOSING



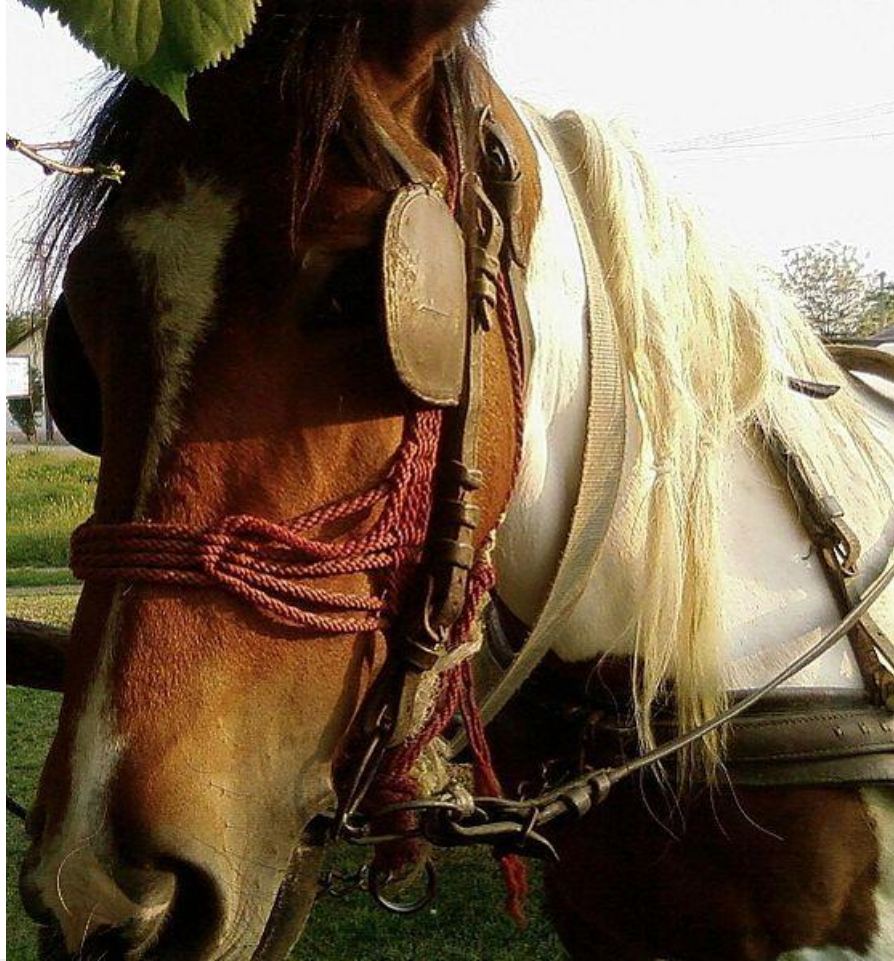
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Blinders On



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Crowding Out

Can my thinking go here?

And this is only page 1!



Name: _____

1 The Capital Area Dog Show judged dogs in 8 groups. There were 3 winners in each group. Each winner received a trophy that cost \$4. What was the total cost, in dollars, of all the trophies?

4 Sarah's mom made 40 cookies for Sarah's pool party. There are 9 children at the party including Sarah. Sarah's father gave her \$20 for decorations. If each child ate the same number of whole cookies, how many whole cookies did each child eat?

2 Before leaving on a trip, several Girl Scout troops were meeting at the mall to carpool. Each car will hold 6 people. If there were 85 people going on the trip, what is the least number of cars needed so that everyone has a ride?

5 Devin is reading a book that has 50 pages. He has nine days to finish the book. Which is closest to the number of pages Devin must read each day in order to finish the book on time?

- A 91 cars
- B 14 cars
- C 15 cars
- D 7 cars

- A 30 pages
- B 40 pages
- C 50 pages
- D 60 pages

3 There were a total of 48 contestants in a scavenger hunt. The contestants were separated into 4 equal teams. Which diagram below correctly models this situation?

6 The diagram shows marbles different students collected in a fun math game.

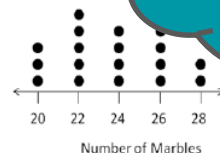
- A

	?
48	4
- B

	48
4	?
- C

	?		
48	48	48	48
- D

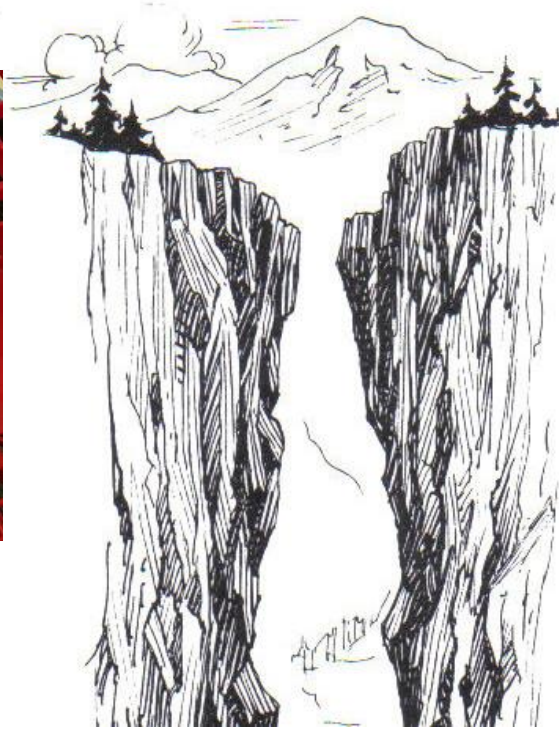
	48
?	



What is the total number of marbles collected by the students who had 26 marbles?



Gaps in Understanding



Jana bought 1 hat and 2 skirts. The hat cost \$28.53, and the skirts cost \$15.88 each. What is the total cost in dollars and cents of the items Jana bought?



Culture of Sense Making

- Take the blinders off
- Provide space and time to think
- Bridge gaps in understanding



Numberless Word Problems



Be in touch.

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