



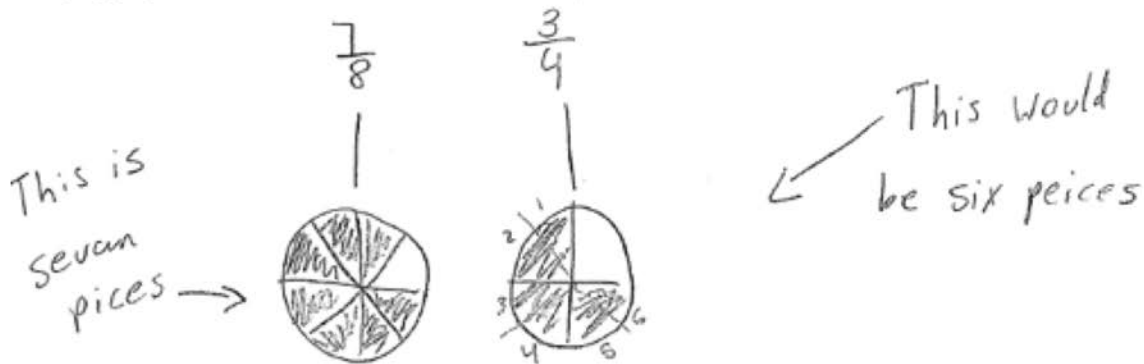
Engaging in Rich Tasks



origoeducation.com

Abstract Representation

Sheliah thinks that $\frac{7}{8}$ is greater than $\frac{3}{4}$.
Peter says that $\frac{7}{8}$ is less than $\frac{3}{4}$. Who is correct and why? Use numbers and symbols to thoroughly explain your answer.



Peter is wrong because $\frac{7}{8}$ is more than $\frac{3}{4}$
Sheliah is correct because $\frac{7}{8}$ is more than $\frac{3}{4}$

Sheliah

Peter

 = correct

Growth Mindset Tasks

- Include multiple methods and representations
- Provide inquiry
- Allow opportunities to solve the problem before teaching the method
- Include a visual component
- Provide extensions to make a lower floor and higher ceiling
- Require students to think critically, employ math reasoning, and validate their thinking

Boaler, 2016, p.90

Tasks for Discourse

- | | |
|---|---|
| • Does the problem involve meaningful mathematics? | • Is the problem challenging for students? |
| • Does the problem provide an opportunity for students to apply and extend mathematics? | • Does the problem support the use of multiple strategies? |
| • Is the problem interesting to students? | • Will students' interactions with the problem reveal information about students' mathematical understanding? |

Dixon, J. K., Adams, T. L., Nolan, E. C., & In Kanold, T. D. (2015). *Beyond the common core: A handbook for mathematics in a PLC at work.*

Feathering the Nest

- **Arrange the room to make talking together easier**
- **Model and practice a climate of trust, respect, and support**
 - Encourage and support risk taking and mistakes
 - Define roles
 - Plan for questioning
 - Post and practice talk moves and sentence stems
- **Provide appropriate tasks with matching questions**

Risk-taking Protocol

Think on your own.

- Time and direction depends on age of students
- Time increases as year progresses

Pair up - share ideas with a partner

Square up – share ideas with another pair

Group share

- Focus on thinking, processes, strategies
- Include sharing of written work (words and pictures)

Supporting the Struggle

Set expectations early

Be firm

Celebrate the small contributions & the struggle

Try questions:

- I know you don't, but if you did...?
- What's one thing you know?
- What tools might help you?
- Were you thinking ____ or were you thinking ____?

Roles During Discourse

Teacher

- Engage students in sharing ideas using multiple representations
- Select and sequence shared work
- Facilitate discourse – more student talk, less teacher talk
- Ensure progress towards mathematical goals

Student

- Present and explain ideas and representations
- Listen carefully and critique the reasoning of others
- Seek to understand approaches used by others
- Compare and contrast various approaches

Funneling Questions

Guide the student down the teacher's chosen path.

- What if you tried *this* here?
- So you could find *this* first?
- What if you did *this* instead of *that*?

Focusing Questions

Help push student thinking forward.

- Where could you start?
- What are you trying to figure out?
- Why does that work?
- Is there another way to approach it? To represent it?
- How are these ideas related

Teacher Roles for Questioning

Advance student thinking with focusing questions

Ask questions that require justification

Ask intentional questions that make the mathematics visible

Allow wait time

Student Roles for Questioning

Expect to be asked to explain, clarify, and elaborate

Think carefully and take time to craft a clear response

Reflect and justify reasoning

Listen to, comment on, and question classmates comments

Additional Questions to Support Discourse

What decisions did you make?

Can you tell me more about...?

Can you explain a different way?

What patterns do you notice?

How does ____ relate to ____?

What can you tell me without solving the problem (performing computation)?

Rather than trying to add the numbers, try thinking about the pattern.

What do you think about Jorge's question/statement?

Who can repeat what Jessica said in their own words?

Support Discourse with Talk Moves and Sentence Stems

Clarification and explanation

- Could you describe what you mean?

Justification

- How did you know?

Recognize and challenge misconception

- I don't agree because..
- Have you considered an alternative?

Interpret and use other's statements

- I heard Charla say...and that makes me think...

Require evidence

- Can you give me an example?

Surface Learning

Initiation to new ideas

Begins with development of conceptual understanding

Followed by associated procedural skills

What did you notice?

How does this connect to our model?

What would happen next?

What is this called?

How can I write this?

What does this symbol represent?

Deep Learning

Consolidating understanding of concepts and procedures

Making connections among ideas

Did you notice any patterns that helped you determine where to place your counter and score more points? If so, what were those patterns?

Did your partner have a different strategy? How was it different? Can you think of any ways to improve your strategy or your partner's strategy?

Utilize the questions from talk moves.

You are going to play a game in pairs. Thinking about patterns may be helpful.

The cube has the numbers from 3-8. We are going to multiply the number we roll by 8.

Before we roll, we have to predict the product, verbalize the strategy we are using, and place our counter on the number we predicted.

Use tally marks to tally your score, based on our scoring system.

The first person to reach 30 points wins.

Product matches counter – 5 points

Product in same column as counter – 2 points

Product in same row as counter – 1 point

21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70

Directions

- Predict the product and place your counter on the number.
- Take turns rolling the number cube and using the double-double-double strategy to multiply the number by 8.

Points

- Record the number of points each person received for the round.
- The first person who reaches 30 or more points wins.
- 5 points – The product matches the counter.
- 2 points – The product is in the same column as the counter.
- 1 point – The product is in the same row as the counter.

Transfer Learning

Apply learning to new situations

Think metacognitively.

- Self-questioning
- Self-reflection

Written discourse

Near and far transfer

Discourse and Metacognition – Teacher Questions

Tell your partner what you think the problem is about.

Make a list of the things you understand about the problem.

Make a list of the things you understand about the problem?

Self-questioning

- What do I know about the problem?
- What is the problem asking me to find out?
- What strategies can I use to understand the problem better?
- Have I seen something like this before?

Self-reflection

- How is my answer similar to/different from my other students' solutions?
- How do I know my solution is correct?
- How well did I communicate my thinking?
- Could I have done this a different way?
- What if...?



Modules 4–6

State Capital Field Trip Plan

75 students in Grade 4 are going on an annual field trip to the state capital. 15 adults will lead a number of student groups. Students pay \$4 each and adults pay \$12 each for the field trip.

School buses will drop everybody off at the Capitol Building in the morning, and then depart from the same location later that afternoon.

All student groups must visit the Capitol Building, eat lunch in the City Park (at some point), and visit one other place near the Capitol Building. This means that each group will miss out on visiting one location. Groups can walk for part of the day and take a van for part of the day.

Here is the **Mileage Chart** that shows the distances between each location:

Mileage Chart					
		End Point			
		To Capitol Building	To State Museum	To City Park (for lunch)	To Outdoor Farmer's Market
Starting Point	From Capitol Building		$\frac{1}{4}$ mile	$\frac{3}{4}$ mile	$1\frac{1}{2}$ mile
	From State Museum	$\frac{1}{4}$ mile		$\frac{1}{2}$ mile	1 mile
	From City Park (after lunch)	$\frac{3}{4}$ mile	$\frac{1}{2}$ mile		$\frac{1}{2}$ mile
	From Outdoor Farmer's Market	$1\frac{1}{2}$ miles	1 mile	$\frac{1}{2}$ mile	

Compare the amount that the adults and students pay to go on the field trip. Describe the relationship between the two amounts.

The week before the trip teachers had collected \$284 for the students and \$144 for the adults. How many students and how many adults still need to pay for their trip..

All groups will start their day at the Capitol Building and end their day at the Capitol Building. Any group that travels more than 2 miles total during the day can take a van for part of the day. The groups in Mr. Owada's class made these plans.

Group Number	Mr. Owada's Class Walking Plan	Total Miles Walked
1	Capitol > State Museum > Lunch > Capitol	
2	Capitol > Lunch > Farmer's Market > Capitol	

Which group can take the van?

- Fill in the Total Miles Walked on the table.
- Write which group can take the van.



Modules 4–6

Use the information from the **State Capital Field Trip Plan** and **Question 3** to solve.

4. For each $\frac{1}{4}$ mile walked, the class earns 10 Mileage Club Points at school. After 500 points are earned, the class receives a bonus recess. Mr. Owada's class already has 130 points. They would like to earn a bonus recess after the field trip.

Mr. Owada's class has been split into five groups.

- Each group will keep track of the number of $\frac{1}{4}$ miles they walk on their field trip.
- All five groups decide not to use a van.

Julia says they will earn 500 Mileage Club Points after the field trip. Natalie disagrees. Do you agree with Julia or Natalie? Show your thinking and explain why.

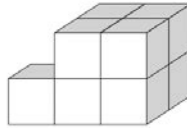
For this item you need to:

- Fill in **Total Miles Walked** and **Total Mileage Club Points** for each group on the table below.
- Decide if you agree with Julia or Natalie.
- Show why.

Group Number	Mr. Owada's Class Walking Plan	Total Miles Walked	Total Mileage Club Points
1	Capitol > State Museum > Lunch > Capitol		
2	Capitol > Lunch > Farmer's Market > Capitol		
3	Capitol > Lunch > State Museum > Capitol		
4	Capitol > Farmer's Market > Lunch > Capitol		
5	Capitol > State Museum > Lunch > Capitol		

1

How many  in this building?



Thinking Mathematically and Problem Solving

© ORIGO Education



Yellow Tank

2

Jose is 8 years old.
 Previn is 2 years older than Jose.
 Sam is younger than Jose.
 When you add their ages, you get 25.

How old is Sam?

Thinking Mathematically and Problem Solving

© ORIGO Education



Orange Tank

4

This is a mixed-up multiplication table.
 Copy the table.

×	3	2		
	15			20
2			10	
		6		
	12			

The top row should show the numbers 2, 3, 4 and 5.
 The first column should show the numbers 2, 3, 4 and 5.
 Complete the table.

Thinking Mathematically and Problem Solving

© ORIGO Education



Purple Tank

3

Binh is thinking of 2 different prime numbers.

Their sum is 30.

Their difference is 4.

What are the 2 numbers?



Thinking Mathematically and Problem Solving

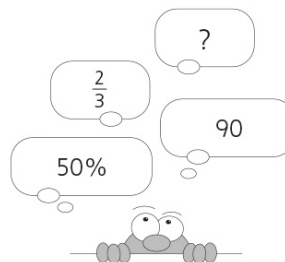
© ORIGO Education

Green Tank

2

a. How much more than **50%** of **90** is $\frac{2}{3}$ of **90**?

b. Write how you figured it out.



Thinking Mathematically and Problem Solving

© ORIGO Education

Red Tank

High Level Discourse

Teacher as facilitator, guide on the side

Student initiated talk, including questions directed to each other

Teacher guides students to contrast strategies

Students justify own thinking

Students use math drawings to describe their thinking and the thinking of other students

Students support and shape each other's thinking

References Cited

- Dixon, J. K., Adams, T. L., Nolan, E. C., & In Kanold, T. D. (2015). *Beyond the common core: A handbook for mathematics in a PLC at work*.
- Hattie, J., et. al. (2017). *Visible learning for mathematics, grades K-12: What works best to optimize student learning*. Thousand Oaks, CA: Corwin.
- Hiebert, J., & Grouws, D. A. (2007). The Effects of Classroom Mathematics Teaching on Students' Learning. In F. Lester (Ed.), *Second Handbook of Research on Mathematics Teaching and Learning*. Charlotte, NC: Information Age.
- Hoffer, Wendy Ward. (2012). *Minds on mathematics: Using math workshop to develop deep understanding in Grades 4-8*. Portsmouth, NH: Heineman.
- Hufferd-Ackles, K., Fuson, K., & Sherin, M. G. (2004). Describing levels and components of a math-talk community. *Journal for Research in Mathematics Education*,.
- (2014). *Principles to actions : ensuring mathematical success for all*. Reston,VA:NCTM, National Council of Teachers of Mathematics,
- Russell, Schifter, & Bastable. (2011) *Connecting arithmetic to algebra*. Thousand Oaks, CA: Heinemann.
- Wong, H. K., Wong, R. T., & Seroyer, C. (2009). *The first days of school: How to be an effective teacher*. Mountain View, CA: Harry K. Wong Publications.