

# Building Collective Mathematical Knowledge

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# Collective Workspace





# Collective Workspace

A teacher is pointing at a whiteboard in a classroom. The whiteboard is covered with student work, including a tree diagram, a number sentence, a toppings list, and a multiplication problem. The teacher is a woman with dark hair, wearing a white cardigan over a black top. She is holding a green marker and pointing at the whiteboard. The whiteboard has several sections of student work:

- tree diagram:** A diagram showing a hierarchy of toppings: Pepperoni, Sausage, Mushroom, and Sausage. It also includes a list of toppings: Pepperoni, Mushroom, Sausage, and Mushroom.
- Number sentences:** A pink sticky note with the text "Number sentences". Below it, a student has written:  $(2 \times 2) \times 2 = 8$  and  $2 \times 2 = 4 \times 2 = 8$ . The name "Victoria" is written above the equations.
- Toppings:** A list of toppings: Pepperoni, Plain, Mushroom, and Sausages. The name "Hannah" is written next to the list.
- Organized list:** A pink sticky note with the text "Organized list". Below it, a student has written: "Cilantro 1 topping" and "4".

The teacher is pointing at the whiteboard. In the foreground, there is a wooden desk with a large clear water bottle and an orange folder. The back of several students' heads are visible in the foreground, indicating they are sitting at the desk.

# Collective Workspace

## *The Definition:*

*Collective Workspace* was a method for students to bring their individual work to their group and discuss different solution strategies and compare.

# Collective Workspace

## *Student Responsibility:*

- look for connections, efficiency, multiple representations and generality
- connect their way of knowing to other strategies
- debate which strategy was most efficient and effective to broader classes of problems



# Poster Proofs

## COMBO

problems

1 Multiplication strategy - First you look at the categories. Count the choices for each category. Multiply each category's # of choices together.

2 Organized List - Take 1 choice from each category and put them together for your 1<sup>st</sup> combo. Change choices for each category 1 by 1 until you've written all possible combos.

\* quickie \* - do this method for 1 category's choice then multiply by the # of choices in this category.

Chart - make a chart for two of the categories. (kinda looks like an array) This will give you the # of combos for these items (each box = a combo choice). Multiply by 3<sup>rd</sup> category.

Tree Diagram - 1<sup>st</sup> spread out the words (choices) for 1 category. Then add branch for the choices of category 2 to each of the category 1 words. Then, add the choices for the next category to each of the previous category's choices. Add the final branches to get the answer.

\* Quickie \*  
do 1 branch  
multiply  
final # of choices  
by # of previous choices  
# of choices in this category



# Poster Proofs

*The Definition:*

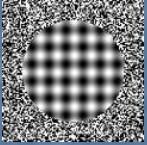
Poster Proofs were created to summarize the essential mathematical learning.

# Poster Proofs

## *Student Responsibility:*

- build on each other's ideas so that every student has ownership of the collective thinking
- engage in building collective knowledge

# PEDAGOGICAL MOVES and QUESTIONING



***Zooming in and zooming out:*** making generalization



***Connecting:*** making connections among representations or algebraic concepts



***Marking:*** marking critical features which the students should pay attention to



***Directing:*** keeps the students on task and encouraged to persist



***Extending:*** Pressing on for justification



***Scaffolding:*** simplifying or clarifying



# Making Generalizations

Divisors	Remainders
1	0,
2	0, 1
3	0, 1, 2
4	0, 1, 2, 3
5	0, 1, 2, 3, 4
6	0, 1, 2, 3, 4, 5
7	0, 1, 2, 3, 4, 5, 6
8	0, 1, 2, 3, 4, 5, 6, 7
9	0, 1, 2, 3, 4, 5, 6, 7, 8

- The largest <sup>possible</sup> remainder is always 1 less than the divisor.
- Remainders are always less than the divisor.

- To find all the possible remainders look at your divisor and the possible remainders are the ~~numbers~~ <sup>digits</sup> less than the divisor.

- 0 will always be a possible remainder.

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# Resources

- M<sup>3</sup> Mentoring Mathematical Minds
- Investigations
- Math 411- Modules