

# Building a Thinking Classroom in Mathematics

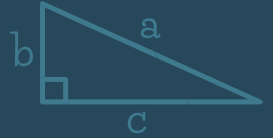


$$2+2=4$$

42:9

x

# Launch



+

+

%

2+

How many?

How do you know?



+

+

x

%

01

Building a Thinking Classroom in Mathematics

03

Classroom Activity

02

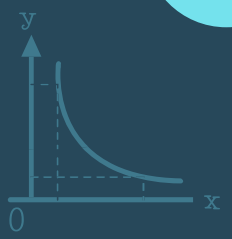
3 act task

04

Time to explore

x

y



$2+2=4$

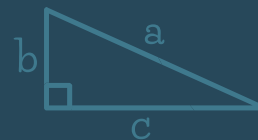
$42:9$

 $x$ 

# 01

# Section

Building a Thinking  
Classroom in Mathematics

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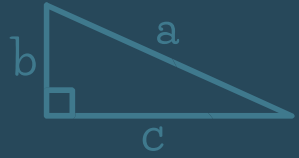
$$2+2=4$$

$$\sqrt[n]{x}$$



$$x/2y$$

- Liljedahl, P. (2014). The affect...
- In Y. Li, & E. Sill...
- Practices. (pp...
- Liljedahl, P. (2013). Kilpatrick, & E. Perspectives. (...
- Liljedahl, P. (2011). Conference of Hungary.
- Liljedahl, P. (2010). The 1st Internat...
- Liljedahl, P. (2009). Amado, & K. Jor... focus on technol...
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- Liljedahl, P. (in pre... Thousand Oaks, CA...
- Mike Pruner, MSc (2006). in Common Places.
- Oana Chiru, MSc (2005). Vertical Surfaces and...
- Maria Kerkoff, MSc (2004). Efficacies in a Thinkin...
- Beth Baldwin, MSc (2003). Perception of their Re...
- Nikki Mann, MSc (2001). Perception of their Re...

The book cover features a white background with an orange border. The title 'BUILDING THINKING CLASSROOMS in MATHEMATICS' is written in large, bold, black letters. Below the title, it says 'GRADES K-12' in a black box. Further down, it lists '14 TEACHING PRACTICES FOR ENHANCING LEARNING' in blue and black text. The author's name 'PETER LILJEDAHL' is at the bottom in large black letters. A foreword by Tracy Johnston Zager and illustrations by Laura Wheeler are also mentioned. The cover art shows three stylized figures (red, orange, and blue) standing around a whiteboard with a grid and a speech bubble.

# BUILDING THINKING CLASSROOMS

RESEARCH: @pgliljedahl  
SKETCHNOTE: @wheeler\_laura

## ① Begin w/ a Problem

Give a problem-solving task

To start:  
Problems should be  
 engaging  
 non-curricular  
 collaborative  
↳ promote talking

Later:  
Problems can be curricular  
eg textbook problems

## ② Visibly Random Groups

Randomly assigned  
eg playing cards

Daily & in front of students

2 or 3 students / group

Sit & stand together


## ③ Vertical NonPermanent Surfaces

Vertical  
 Erasable

 WHITEBOARD  
 CHALKBOARD  
 WINDOW

1 marker or chalk per group  
↳ promotes discussion

## ④ Oral Instructions

 give instructions orally

 Project


data  
long expressions  
diagrams

→ groups will discuss (instead of decoding text)

## ⑤ Defront the room

Desks → orient in various directions  
pull away from wall (room to stand @ VNPS)

Teacher addresses the class from a variety of locations.




## ⑥ Answering Questions

Acknowledge, but don't answer:

Proximity questions (b/c teacher is close by)

Stop thinking questions

Answer:  
 Keep thinking questions  
↳ give HINTS not answers


 is this right?

## ⑦ Build Autonomy

Model how groups can visit other groups when they are stuck or done.

Hints & extensions come from peers (not just the teacher).

→ Helps manage flow



$2+2=4$

Where should students write?

+

x

-

## VERTICAL NON-PERMANENT SURFACES

in math class

**WHITEBOARD**

VERTICAL (ie, wall mounted)

ONE MARKER PER GROUP

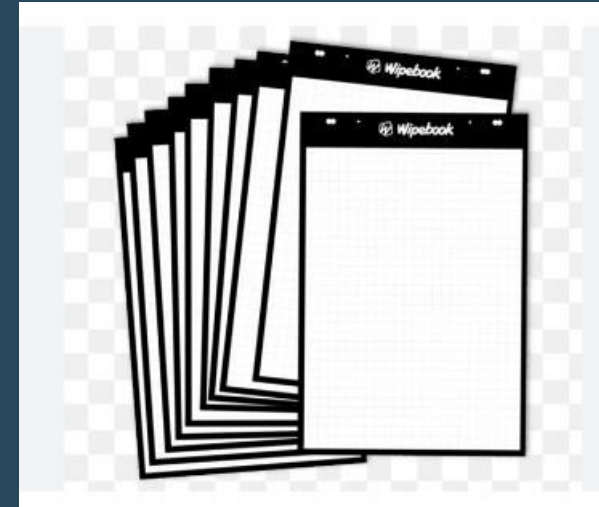
ERASABLE

STUDENTS STAND

You can also use...

chalkboards!

Windows with whiteboard markers





$2+2=4$

# How should I determine the groups?

+

x

42:9

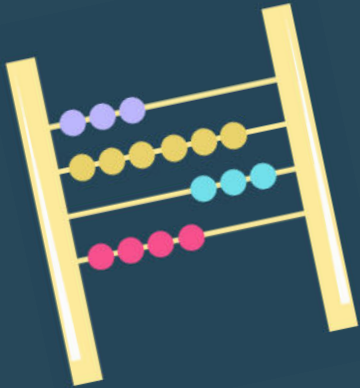
## VISIBLY RANDOM GROUPS

in math classrooms

<p><b>Strategic Groupings Goals</b></p> <p><b>Educational</b></p> <ul style="list-style-type: none"><li>• pedagogical</li><li>• productivity</li><li>• peacefulness</li></ul> <p><b>Social</b></p> <ul style="list-style-type: none"><li>• diversity</li><li>• integration</li><li>• socialization</li></ul>	<p><b>Visibly Random Groups</b></p> <p>students need to see!</p> <p><del>teacher assigns</del> students choose</p> <p>3s are ideal</p>		
<p><b>SEPT 1</b> Can be introduced ANYTIME in a course so start TODAY! &amp; repeat DAILY!</p>	<p>Students become agreeable to WORK in any GROUP they are placed in</p>	<p>Eliminates social barriers</p>	<p>Mobility of Knowledge between students</p>
<p>Reliance on teacher for answers</p>	<p>Reliance within and between groups for answers</p>	<p>Engagement on task</p>	<p>Enthusiasm for the class (even if the subject is not their favorite)</p>

Sketchnote: @vukobur\_haura

Research: Peter Lijndahl



$$2+2=4$$

+

x

- use thinking tasks
- use vertical non-permanent surfaces
- frequently form visibly random groups
- give task early, standing, and verbally
- defront the classroom
- answer only keep thinking questions
- be intentional less helpful
- • use hints and extensions to manage

$$\sqrt[n]{x}$$

$$x/2y$$



$2+2=4$

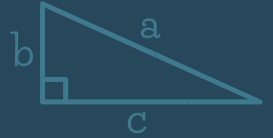
$42:9$

x

# 02

## Section

3 act task



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Engaging way to push for collaborative problem-solving that disrupts the traditional “I do, we do, you do” instructional model

### **Act 1**

You do

Notice & wonder  
Predict the  
question  
Estimate

### **Act 2**

Y'all do

Predict the info  
needed  
Collaborative  
groups

### **Act 3**

We do

Select and  
sequence with  
class discussion  
The big reveal

## Act 1: Engage and Perplex

- Provides a visual- either a photo or video- to hook the viewer into the task
- Sparks curiosity
- Provokes questions
- Students “Notice” and “Wonder”
- Students define the question (Possibly with teacher guidance)



$$2+2=4$$

## Whoppers

+

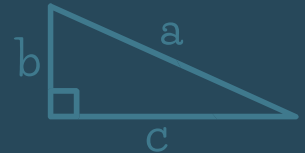
x

What do you notice?  
What do you wonder?

$$\sqrt[n]{X}$$

Main Question: How many whoppers are in the jar?

What information do you need to answer the main question?



$$2+2=4$$

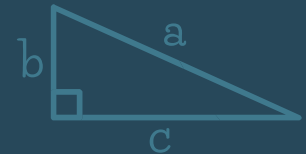
Act 2

+

x

Main question: How many whoppers are in the jar?

$$n\sqrt{x}$$



## Act 2: Seek information and Solutions

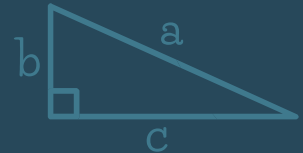
x

How many whoppers are in the jar?

$n\sqrt{\pi}$   
What is an unreasonable estimate for this problem?

What estimate is too high?

What estimate is too low?





## Students “do some work”

- Students will work independently, in pairs, and/or in small groups
- The teacher observes students as they work and offers support as needed
- The teacher also is considering how they will facilitate the debrief (this requires consideration of solutions, strategies, and questions they will ask)

$$2+2=4$$

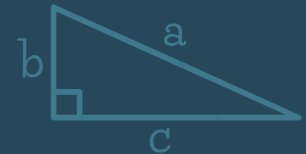
Act 2

+

x

Main question: How many whoppers are in the jar?

$$n\sqrt{x}$$



## Act 3: The reveal!

- The teacher facilitates a discussion based around the solutions and strategies - students should do most of the talking
- Once students have come to a version of consensus (depending on the specific 3 Act Task) the teacher will reveal “the answer”



Whoppers reveal

$x/2y$

# 3 Act Tasks

+

x

- take some time to explore these tasks
- which unit would these fit with?

-examples

x



$2+2=4$

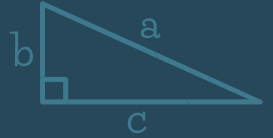
$42:9$

x

03

# Section

Classroom  
activity

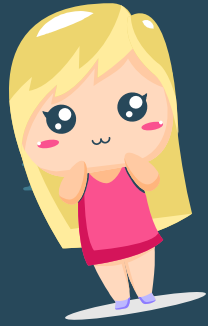


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## Guidelines for classroom activity

x/2y

- explain task
- random groups (count off, deck of cards)
  - 3 in a group
- if using posters have them numbered ahead of time



$2+2=4$

# 31-derful

+

x

31-derful is a fun and easy way to implement group problem solving.

 $\sqrt{x}$ 

**31-DERFUL**

TO PLAY:  
Arrange 25 cards in a 5 x 5 pattern

-

 $x/2y$ 

$$2+2=4$$

+

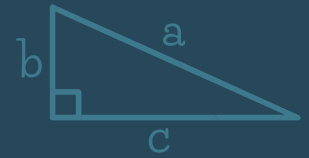
x

Each row and each column needs to add up to exactly 31. Face cards are worth ten and aces are worth 11.

$$n\sqrt{x}$$

**TO WIN:** Each row and each column needs to add up to exactly **31**

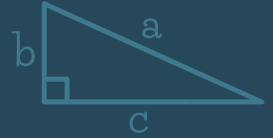
10♠	10♥	10♣	10♦	10♠	31
10♠	10♥	10♣	10♦	10♠	31
10♠	10♥	10♣	10♦	10♠	31
10♠	10♥	10♣	10♦	10♠	31
10♠	10♥	10♣	10♦	10♠	31
31	31	31	31	31	





$$2+2=4$$

x



## 31-derful

The goal of the puzzle is to create rows and columns of cards that the sum

42:9

totals exactly 31

-5x5 array

-Face cards are 10

-Ace cards are 11

**TO WIN:** Each row and each column needs to add up to exactly **31**

31 31 31 31 31

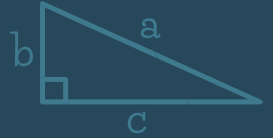


$2+2=4$

$42:9$

x

Let's try  
it!



+

+

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# Alternative resources

$x/2y$



<https://mathequalslove.net/>



[Activities](#)



<https://www.peterliljedahl.com/teachers/numeracy-tasks>



[Open middle](#)