

# See it, Move it, Grasp it: Math with Virtual Manipulatives

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@MrsNewell22 #MathGals

SLIDES:  
[bit.ly/NCTMVM2020](https://bit.ly/NCTMVM2020)

## Welcome !

How are you?

What's something that has  
been *bringing you joy*?



[bit.ly/NCTMVM2020](https://bit.ly/NCTMVM2020)

# GOALS



Do math with virtual manipulatives

Consider when/why/how to access  
& use virtual manipulatives

Compare physical manipulatives  
to virtual ones

Plan for use in your *current reality*

**Manipulatives I use...**

... base ten blocks

...

**because...**

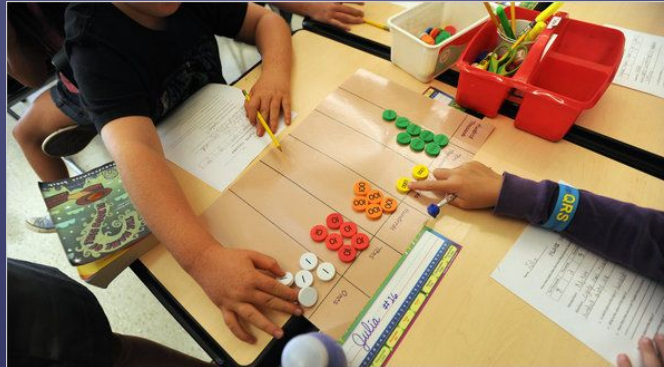
...they help students see the relationships b/w  
ones, tens, hundreds

....

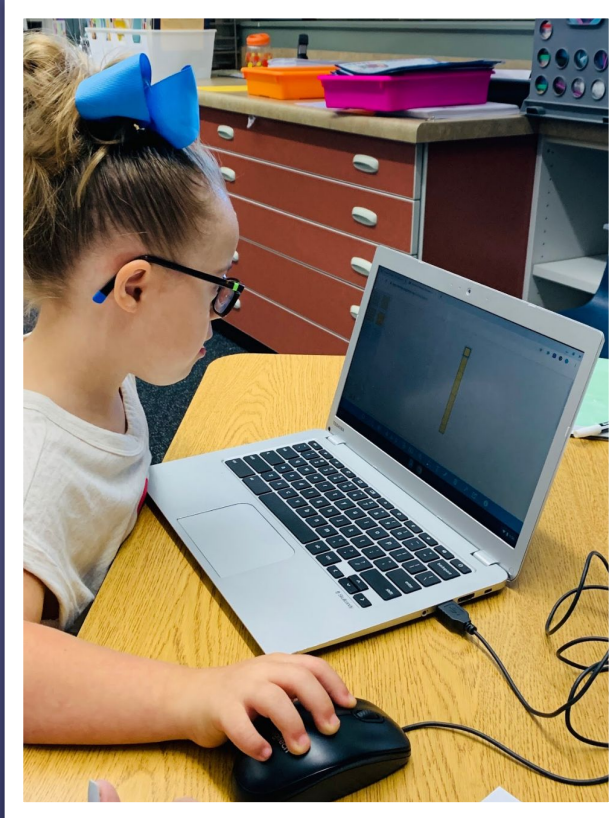


# Why use manipulatives?

“In order to develop every student’s mathematical proficiency, leaders and teachers must systematically integrate the use of concrete and virtual manipulatives into classroom instruction at all grade levels.” (NCSM, 2013)



# Why use manipulatives?



## Manipulatives are...

“... physical objects that students and teachers can use (view, physically handle) to illustrate and discover mathematical concepts....”

Van de Walle, 1994

## Virtual manipulatives are...

“...an interactive, technology-enabled visual representation of a dynamic mathematical object, including all of the programmable features that allow it to be manipulated, that presents opportunities for constructing mathematical knowledge.”

Moyer-Packenham, 2016

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# Effective Use of Manipulatives

“Although kinesthetic experiences can enhance perception and thinking, **understanding does not travel through the fingertips and up the arm.**”

Deborah Ball, 1992





# Effective Use of Manipulatives

“[Manipulatives’] physicality is not important  
- their *manipulability* and *meaningfulness*  
make them educationally effective.”

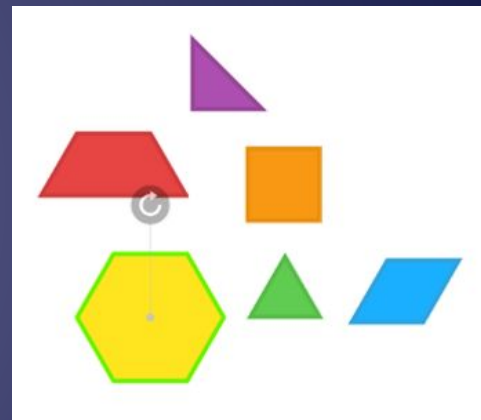
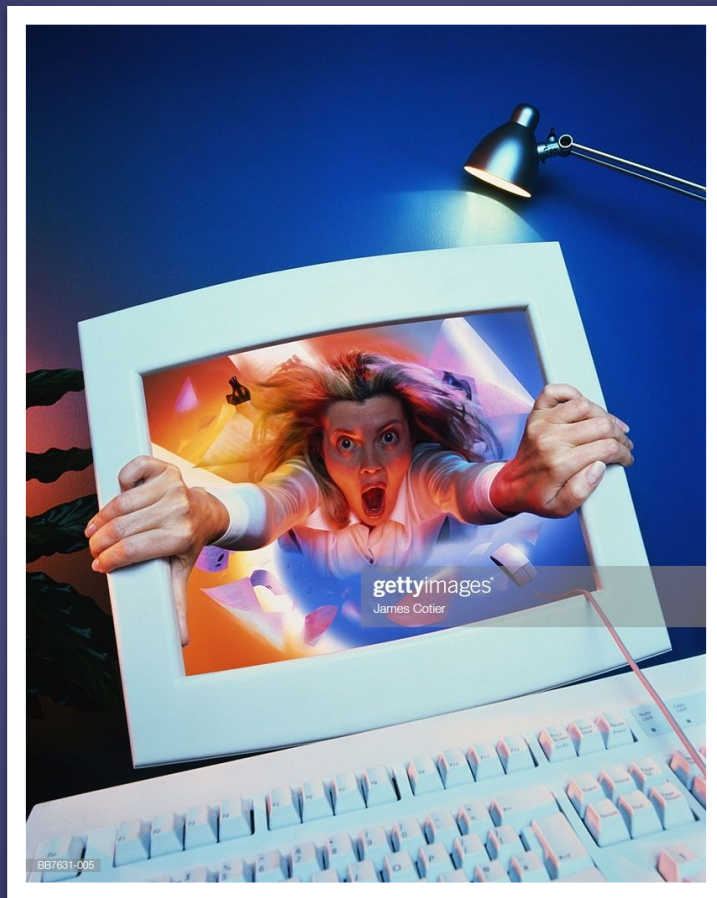
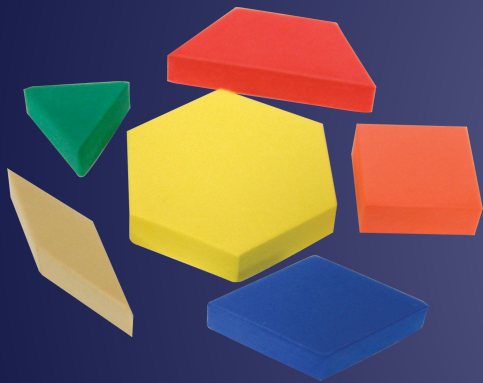
Martin, 2009

# Effective Use of Manipulatives

- Use consistently, over a period of time
- Make connections between the manipulatives & the math concepts
- Reflect on actions with manipulatives to build meaning (Sarama & Clements)

# Effective Use of Manipulatives





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# Degrees of Classroom Technology Integration

Dr. Puentedura

R

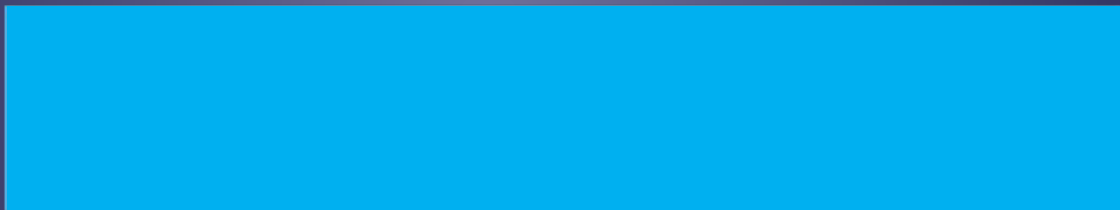


TRANSFORMATION

M

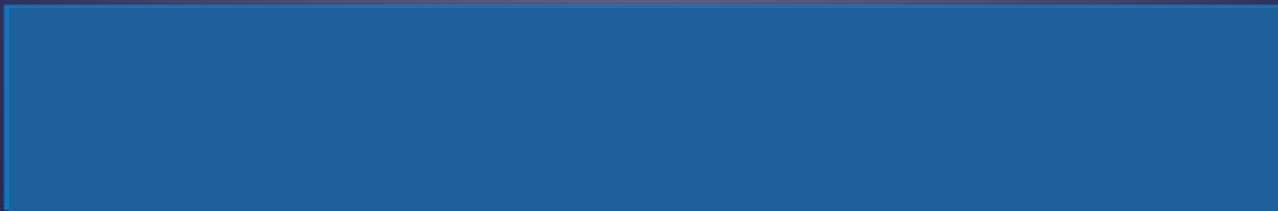


A



ENHANCEMENT

S







## Substitution

Tech acts as a direct tool substitute, with no functional change.

## Augmentation

Tech acts as a direct tool substitute, with functional improvement.

## Modification

Tech allows for significant task redesign.

## Redefinition

Tech allows for the creation of new tasks, previously inconceivable.



# Virtual Manipulatives from Math Learning Center



[mathlearningcenter.org/resources/apps](https://mathlearningcenter.org/resources/apps)

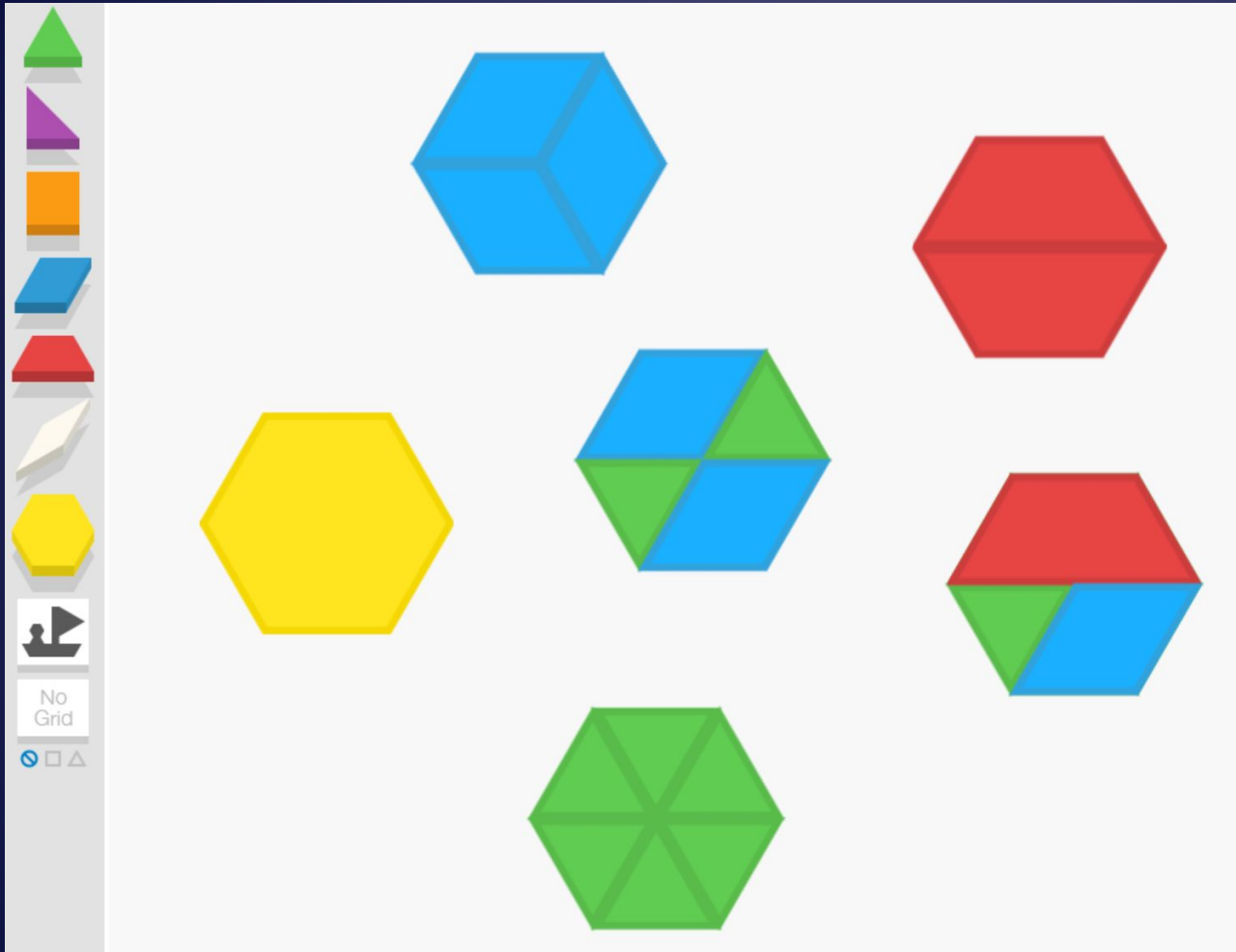


# DO SOME MATH

Let's compose a [regular] hexagon in as many different ways as we can!

**Navigate to:** [bit.ly/NCsMshapes](https://bit.ly/NCsMshapes)





# What can you do?

Place  
Drag  
Rotate  
Duplicate  
Overlay  
Delete  
Resize  
Recolor

# Physical vs. Virtual Manipulatives

What was the same?  
What was different?





# Reflecting on Virtual Manipulative Use Through SAMR

## Substitution

What will I gain by replacing physical manipulatives with virtual ones?

## Augmentation

Do virtual manipulatives add new features that improve the task?

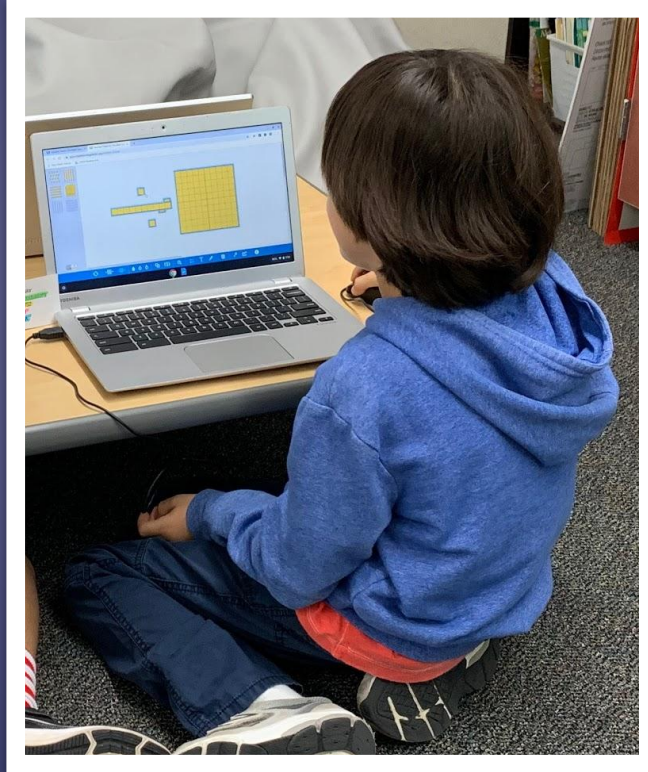
## Modification

Does the task significantly change with the use of virtual manipulatives?

## Redefinition

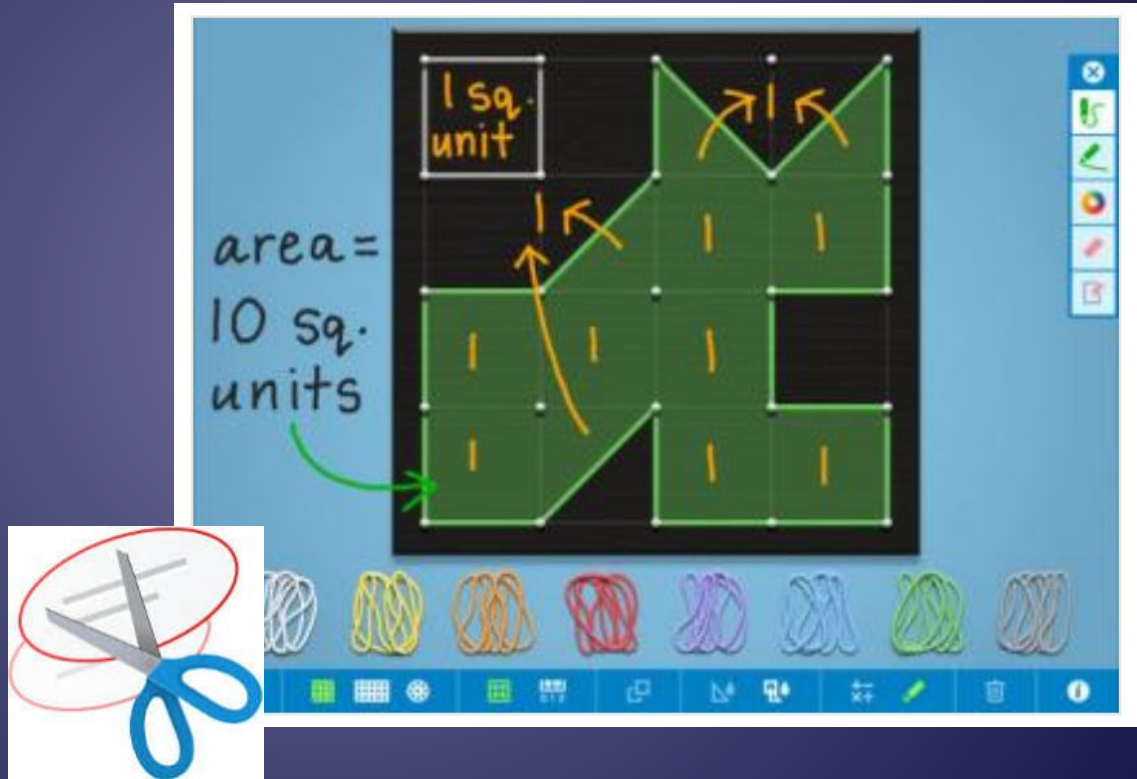
Do virtual manipulatives allow for the creation of a new task previously inconceivable?

# Virtual Apps & Remote Learning



# Snipping and Sharing Work

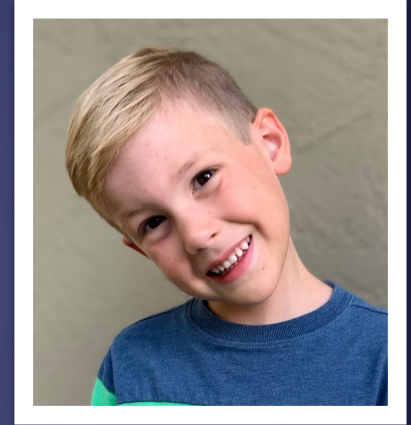
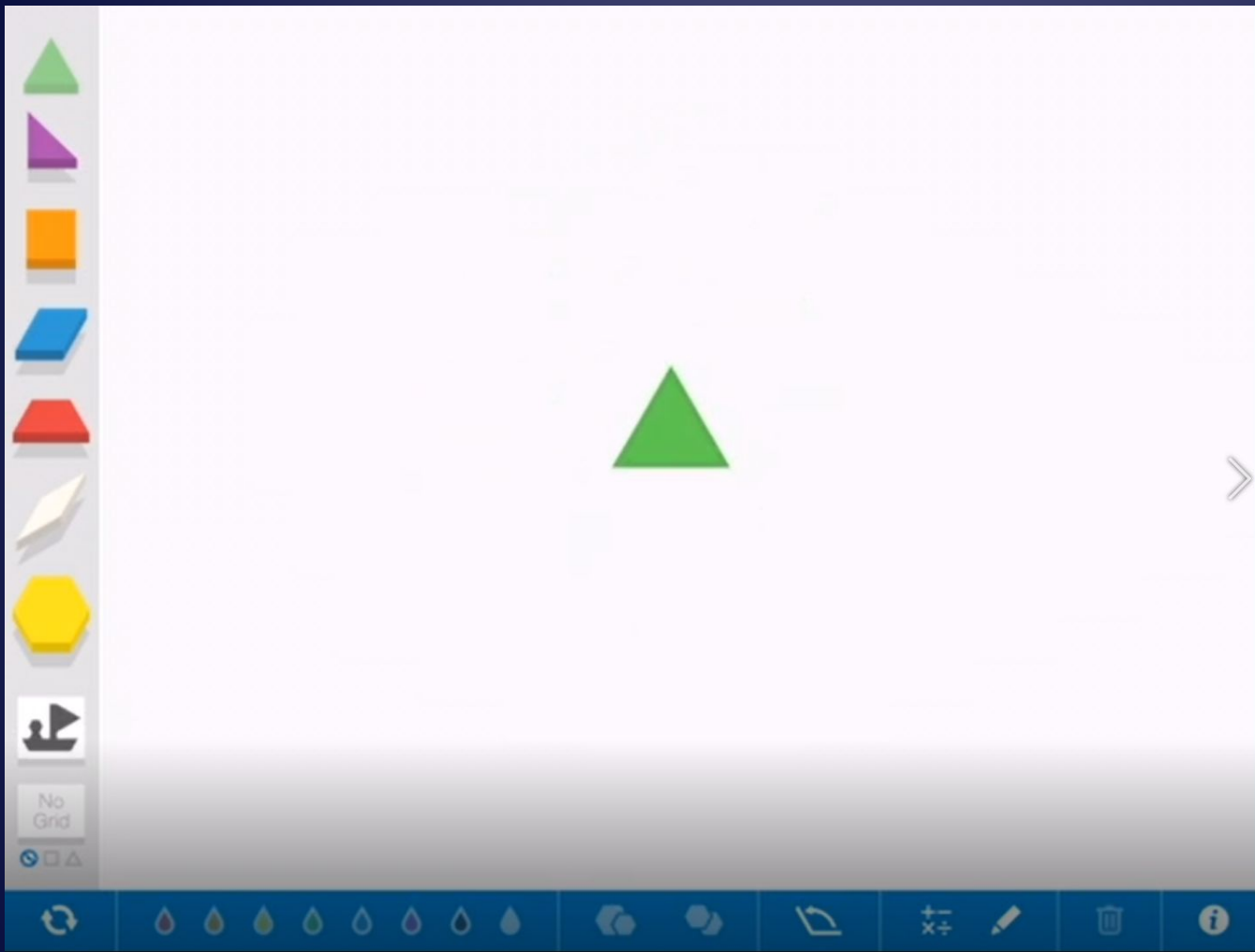
Snipping tool  
Screenshot



# Screencasting for Teaching & Learning

The screenshot shows a web browser window with the address bar displaying `apps.mathlearningcenter.org/pattern-shapes/`. The browser's address bar includes navigation icons (back, forward, refresh) and a lock icon. Below the address bar, there are several bookmark icons: 'Apps', 'Amazon', 'MOOC', 'MS-OTL', and 'Com'. The main content area of the browser shows a webpage with a vertical sidebar on the left containing various 3D geometric shapes (triangles, squares, rectangles, etc.) in different colors (green, purple, orange, blue, red, yellow). The right side of the browser window is partially obscured by a red overlay from the Screencastify extension. This overlay contains the following elements:

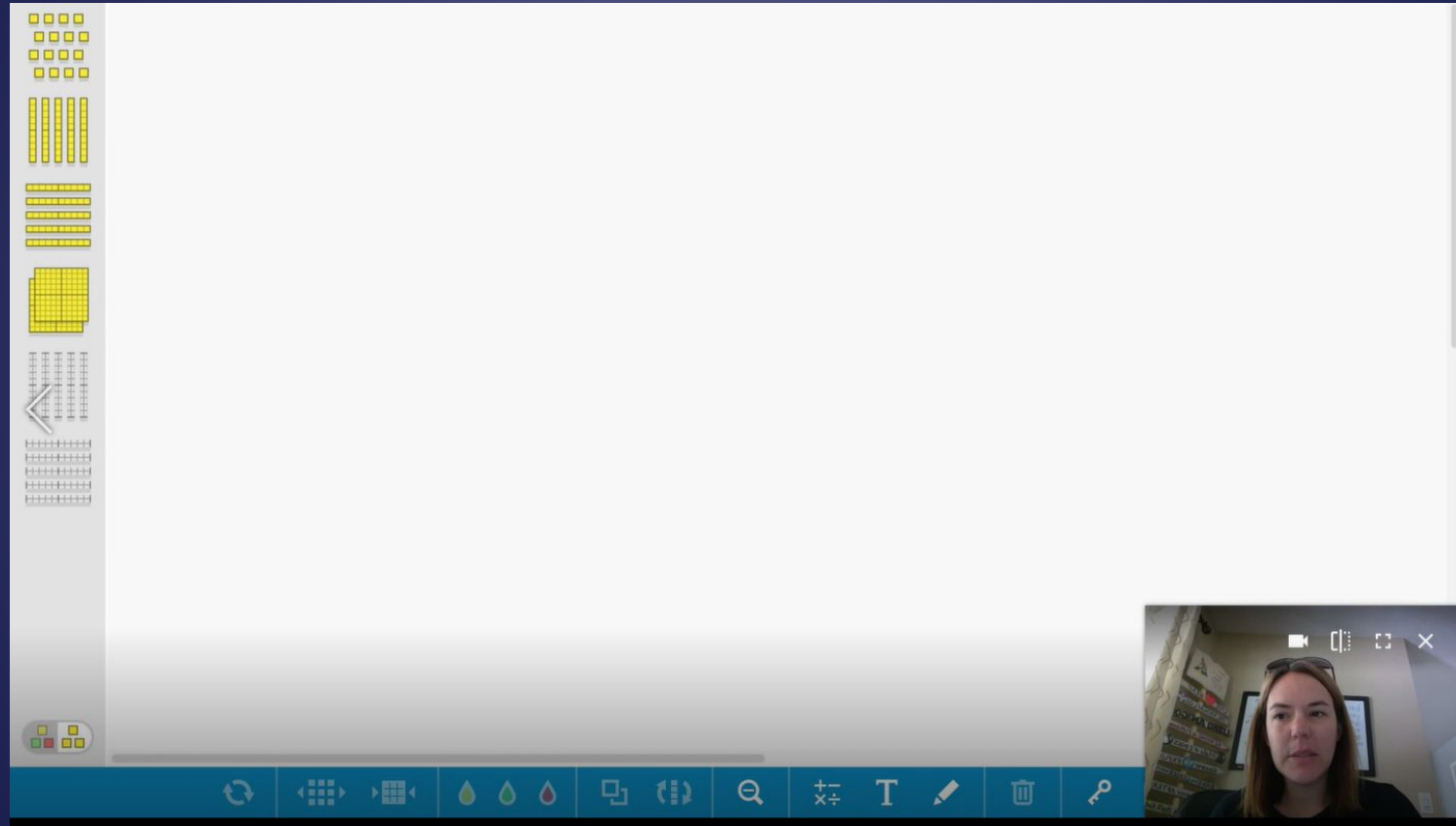
- A red header bar with a hamburger menu icon, a play button icon, a bell icon, and a gear icon.
- A notification area stating: "5 minute limit per video. [Upgrade](#) for unlimited recording and editing."
- The Screencastify logo and the text "ScreencastifyFree".
- Three recording mode options: "Browser Tab" (selected with a red icon), "Desktop" (with a monitor icon), and "Webcam Only" (with a camera icon).
- A "Microphone" section with a toggle switch (turned on), the text "Microphone", a dropdown menu showing "Default - Mi...", and a microphone icon with a volume indicator.
- An "Embed Webcam" section with a toggle switch (turned off) and the text "Embed Webcam".
- A link that says "Show more options".
- A large blue button at the bottom labeled "Record".



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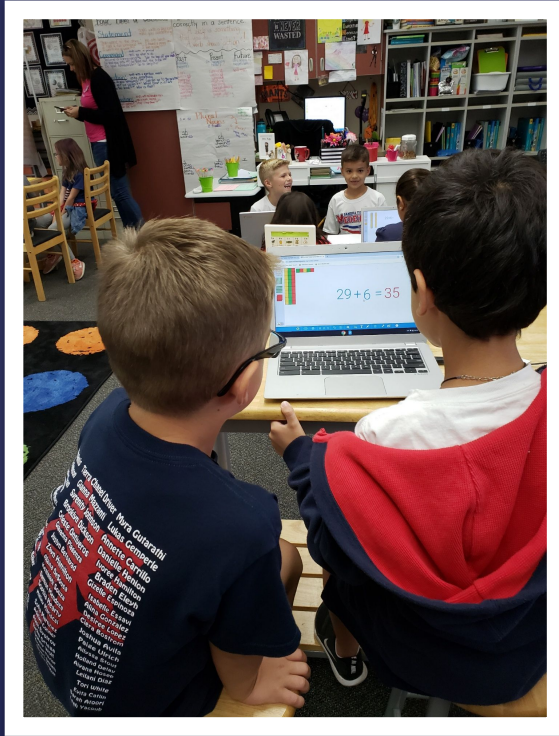


# Screencast of Task/App Launch



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# Virtual Manipulatives in the Classroom



What was the same?  
What was different?





# What can you do with base ten blocks on the computer?

We can rotate it.  
We can change colors.  
We can get more space.  
We can write numbers.  
We can represent addition  
with base ten blocks.  
We can represent subtraction  
with base ten blocks.

- You can delete one block at a time.
- You can color the blocks.
- You can draw numbers.
- You can color the numbers.
- You can zoom in and out.
- You can grab the clear blocks and add more to it.
- You can duplicate the blocks.

# Math Learning Center Sharing Features



Open Web App  
Apple App Store   
Chrome Store 

## SUPPORTS SHARING! Number Frames

Number Frames help students structure numbers to 5, 10, 20, and 100. Students use the frames to count, represent, compare, and compute with numbers in a particular range.

Enter a share code:



OPEN

### Share Your Work



 Share an image

SAVE IMAGE

COPY IMAGE

 Share a link

<https://apps.mathlearningcenter.org/>

COPY LINK

 Share a code

FYJN-FXUW

DISPLAY CODE





# DO SOME MORE MATH

Let's use Base Ten Blocks to add and subtract.

Go to: [bit.ly/MLCBaseTen](https://bit.ly/MLCBaseTen)



# DO SOME MORE MATH


apps.mathlearningcenter.org/number-pieces/

Build the number 136

$87+19$

Try it!  
Then share  
your work!

Go to: [bit.ly/MLCBaseTen](https://bit.ly/MLCBaseTen)

To open, press  and enter:


1NT4-CVFE

## Share Your Work

 Share an image

SAVE IMAGE

COPY IMAGE

 Share a link

<https://apps.mathlearningcenter.org/>

COPY LINK

 Share a code

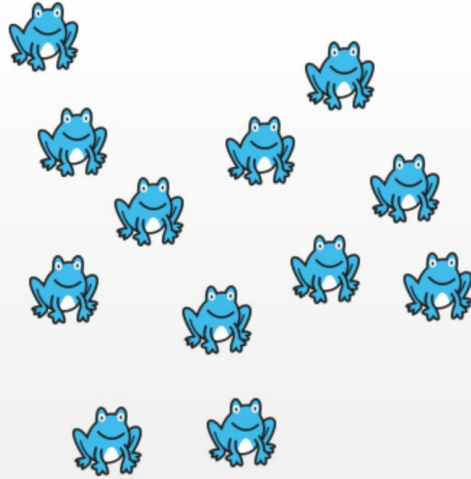
FYJN-FXUW

DISPLAY CODE

# Remote Learning

Monday	Tuesday	Wednesday	Thursday
Push out intro video  Invite students to explore virtual manipulative	Push out a task/problem via Share link or code	Students work on task and share their work back via Share link or code	Select & sequence student work for debrief during class meeting
Asynchronous	Asynchronous	Asynchronous	Synchronous

# Prompt Shared with Students



Rearrange the frogs into an array.

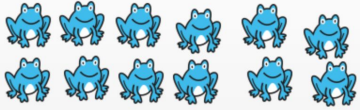
How many frogs are there? \_\_\_\_\_

What repeated addition sentence  
could you write for this array?

\_\_\_\_\_

Build another array with counters below.

# Student Work



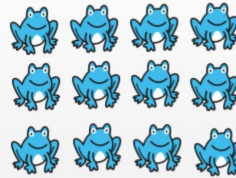
Rearrange the frogs into an array.

How many frogs are there? 12

What repeated addition sentence could you write for this array?

$$6 + 6 = 12$$

Build another array with counters below.



Rearrange the frogs into an array.

How many frogs are there? 12

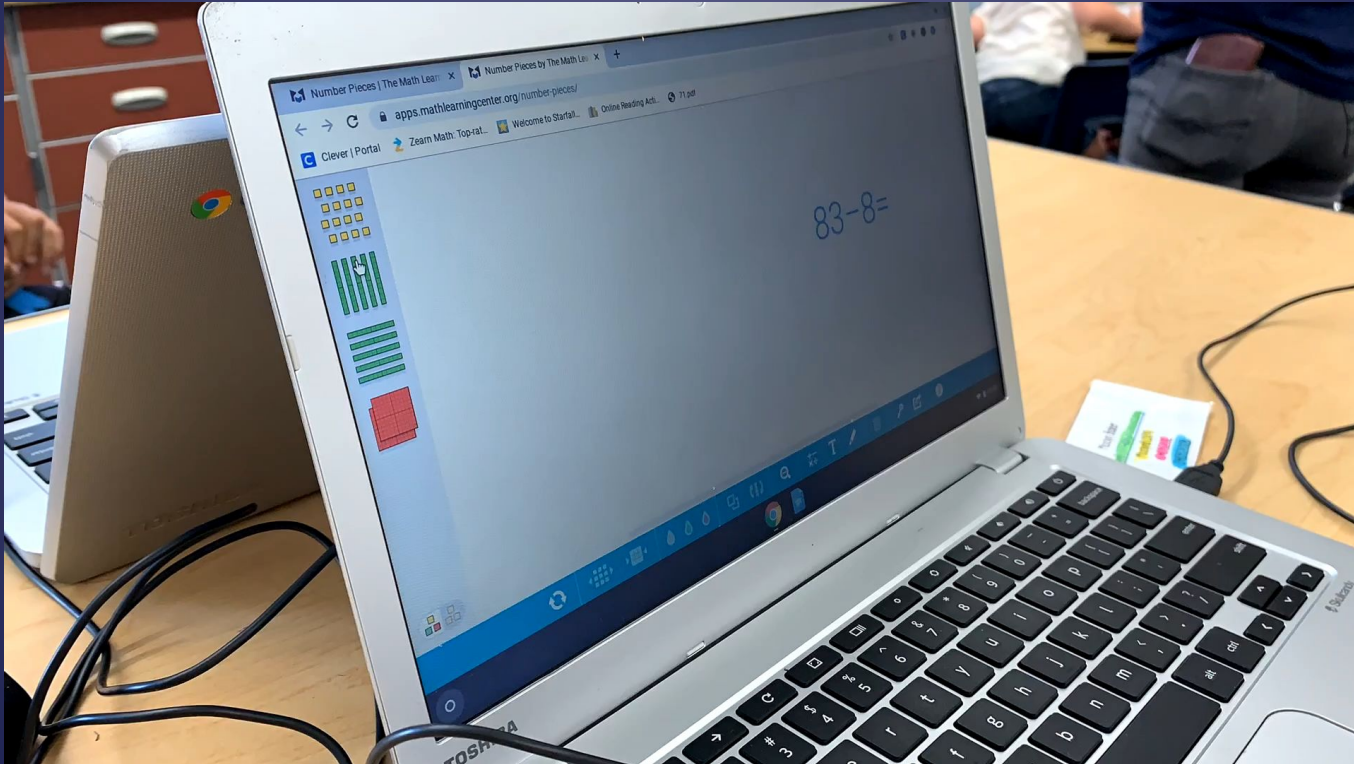
What repeated addition sentence could you write for this array?

$$4 + 4 + 4 = 12$$

Build another array with counters below.



# Virtual Manipulatives in the Classroom



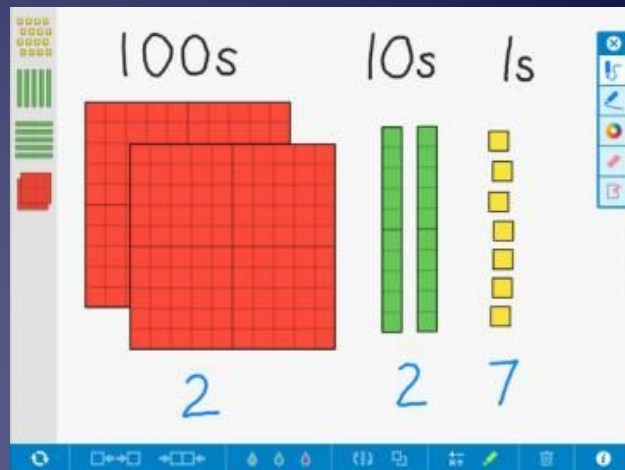


# Virtual Base Ten Blocks through SAMR

Task	Substitution	Augmentation	Modification	Redefinition
Subtract two-digit numbers using [physical] base-ten blocks.	Subtract two-digit numbers using [digital] base-ten blocks.	<p>Subtract two-digit numbers using [digital] base-ten blocks.</p> <p>Use “break” and “join” features to show decomposition.</p> <p>Save your work and send it to your teacher.</p>	<p>Open shared work space.</p> <p>Subtract two-digit numbers using [digital] base-ten blocks.</p> <p>Screencast your session and send it to your teacher.</p>	<p>Work with a remote partner on a shared work space synchronously.</p> <p>Use sharing features to take turns.</p> <p>Invite your teacher to your collaboration.</p>

# Benefits of Virtual Manipulatives

- Support for sense-making built in
- Greater control & flexibility
- React to learners' actions- feedback
- Readily available; easily “managed”
- Ability to record, replay student actions & share work
- Engaging/motivating for students



# Considerations for the use of Virtual Manipulatives

Interface  
familiarity

Student  
arrangement

All learners

SAMR

# Reflecting on Virtual Manipulative Use Through SAMR

## Substitution

What will I gain by replacing physical manipulatives with virtual ones?

## Augmentation

Do virtual manipulatives add new features that improve the task?

## Modification

Does the task significantly change with the use of virtual manipulatives?

## Redefinition

Do virtual manipulatives allow for the creation of a new task previously inconceivable?

# Next Steps

Choose another one of the virtual manipulatives to explore.

How could you design a task that is on the “transformation” end of the SAMR spectrum?



# GOALS



Do math with virtual manipulatives

Consider when/why/how to access  
& use virtual manipulatives

Compare physical manipulatives  
to virtual ones

Plan for use in your *current reality*



# Thank you for attending!

SLIDES: [bit.ly/NCTMVM2020](https://bit.ly/NCTMVM2020)

[Mathlearningcenter.org/resources/apps](https://Mathlearningcenter.org/resources/apps)



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# Explore with Coins



3. 55 cents



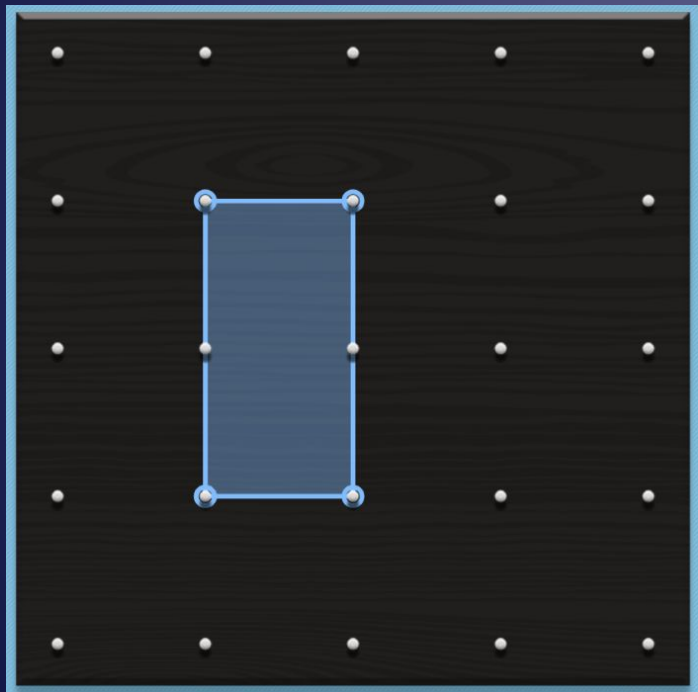
2 quarters and 1 nickel make 55 cents.

Another way to make 55 cents:

Show 20¢ two ways. Use the fewest possible coins on the right below.

Fewest coins:

# Explore with Geoboards



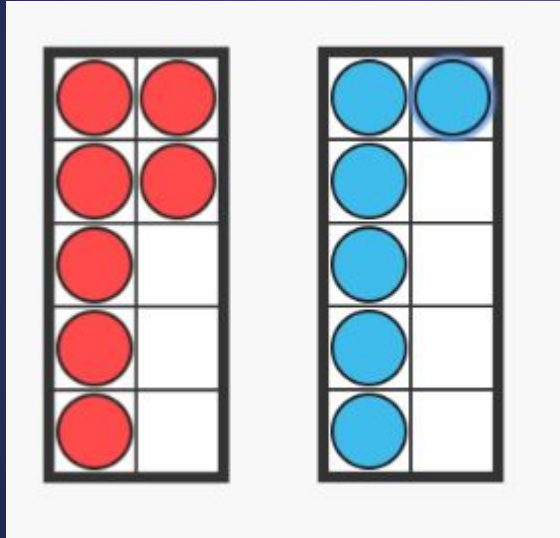
Can you build...

- a shape with 4 sides?
- a shape with 3 sides?
- a shape with 5 sides?

Can you build a different shape?

What precise math words can you use to describe your shape?

# Explore with Counters & Ten Frames



How many?  
How do you know?

Use counters & ten frames to help  
you solve:

$$6 + 9$$

$$7 + 4$$

$$8 + 9$$

$$12 - 7$$

$$15 - 6$$

$$14 - 9$$

# GOALS

- Experience... What is it like to do math with virtual manipulatives?
- Understand... Where can I access virtual manipulatives? When/why use them?
- Reflect... How do physical manipulatives compare to virtual ones?
- Plan... How do I use this in my *current reality*?