

Digital Tools for STEAM

Teaching and Learning

Link to slides: tiny.cc/DTBea

<colette/>



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Roles of Digital Tools in the STEAM Classroom

Teacher tools for

- displaying
- preparing
- collaborating
- exploring
- communicating
- ...

Student tools for

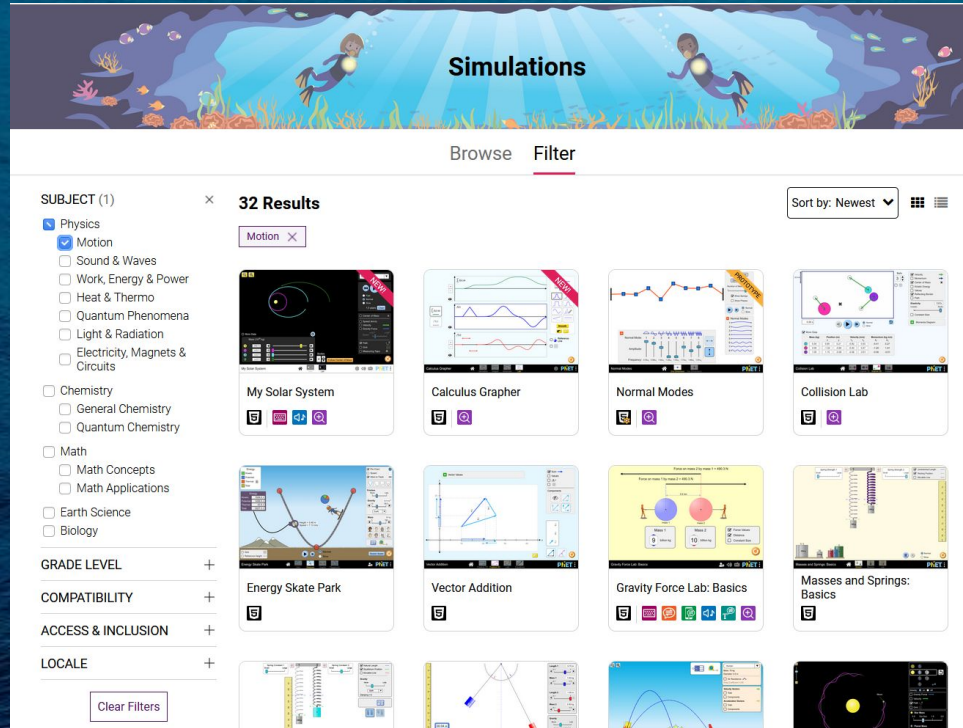
- exploring
- collaborating
- testing conjectures
- access
- learning
- ...

Collecting Data with LabStar or SensorData Apps



LabStar Device or Mobile Phone Apps that collect data on heat, magnetic field, distance, humidity, acidity, heart beat... labstar.inteach.org

PhET - simulations for science and math



The screenshot displays the PhET Simulations website interface. At the top, a banner features two divers underwater with the word "Simulations" in the center. Below the banner, there are "Browse" and "Filter" tabs. The "Filter" tab is active, showing a sidebar with various subject and grade level filters. The main content area displays 32 results for the "Motion" filter, with a "Sort by: Newest" dropdown menu. The results are presented in a grid of simulation thumbnails, each with a title and a small icon indicating its subject area.

Simulations

Browse Filter

SUBJECT (1) × **32 Results** Sort by: Newest

- Physics
 - Motion
 - Sound & Waves
 - Work, Energy & Power
 - Heat & Thermo
 - Quantum Phenomena
 - Light & Radiation
 - Electricity, Magnets & Circuits
- Chemistry
 - General Chemistry
 - Quantum Chemistry
- Math
 - Math Concepts
 - Math Applications
- Earth Science
- Biology

GRADE LEVEL +

COMPATIBILITY +

ACCESS & INCLUSION +

LOCALE +

[Clear Filters](#)

My Solar System

Calculus Grapher

Normal Modes

Collision Lab

Energy Skate Park

Vector Addition

Gravity Force Lab: Basics

Masses and Springs: Basics

Physics, Chemistry, Math, Earth Sciences, Biology

Mathigon - Digital Manipulatives

Dice

Spinners

Origami

Sequences

Tangram

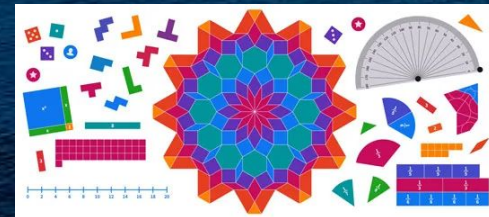
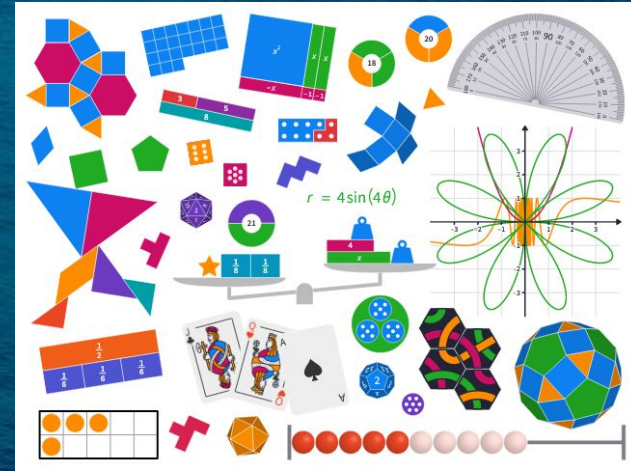
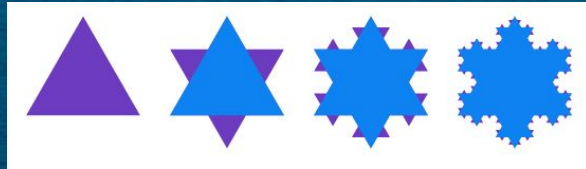
Cards

Algebra Tiles

Tantrix Tiles

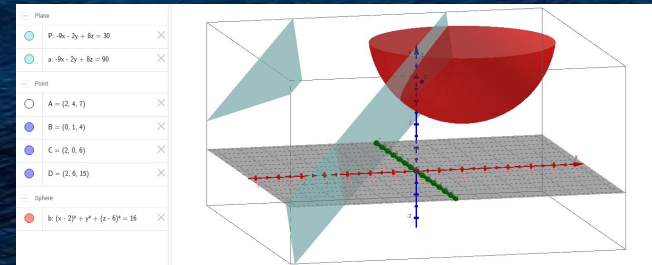
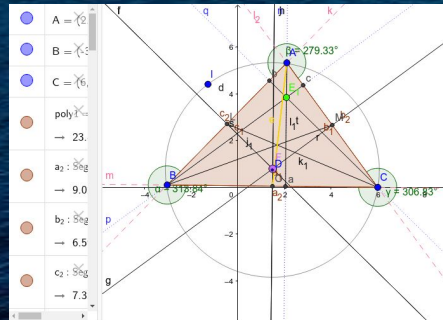
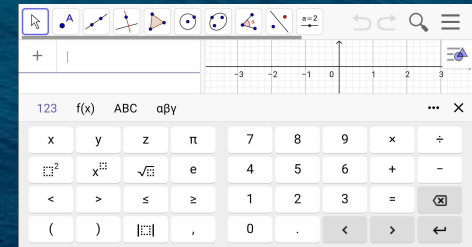
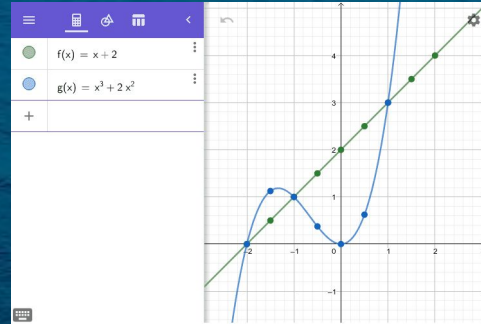
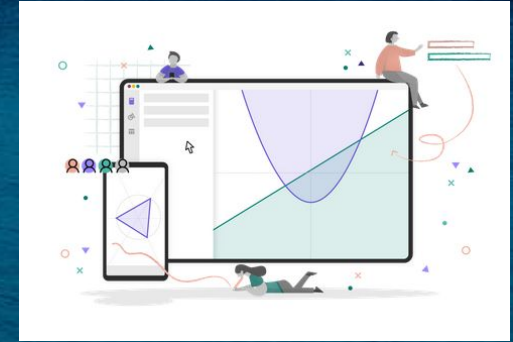
Polygons

...



GeoGebra

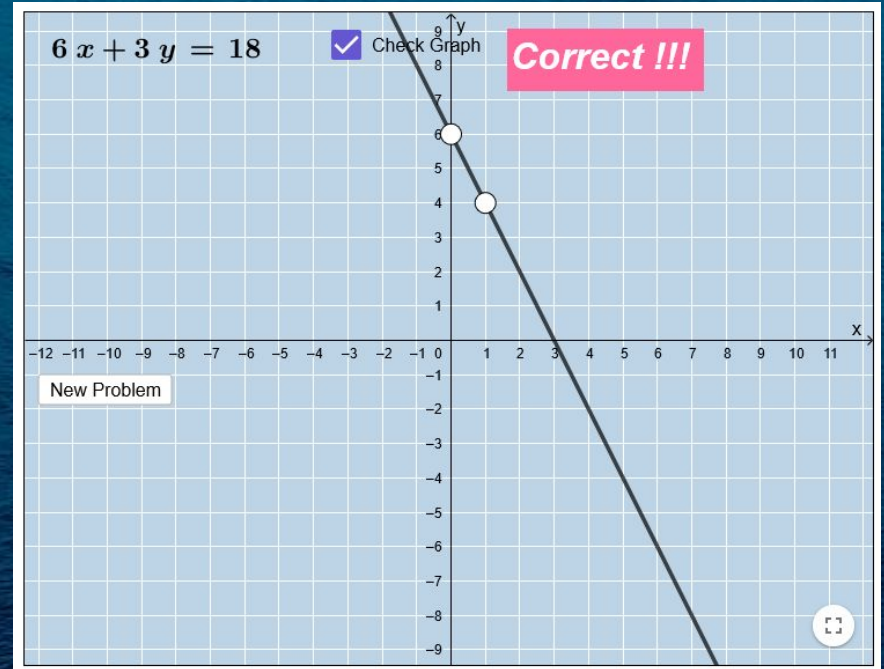
- Graphic Calculator
- Data visualisation
- Modelling
- Experimenting
- Exploring
- Plotting
- Viewing in 3D
- Connected Classroom



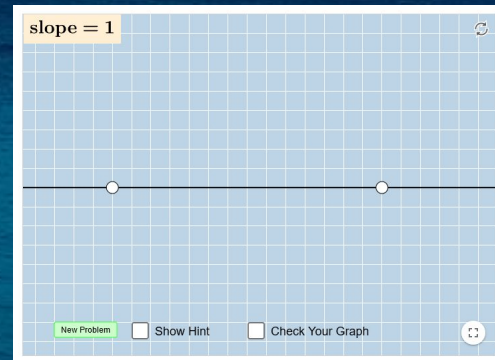
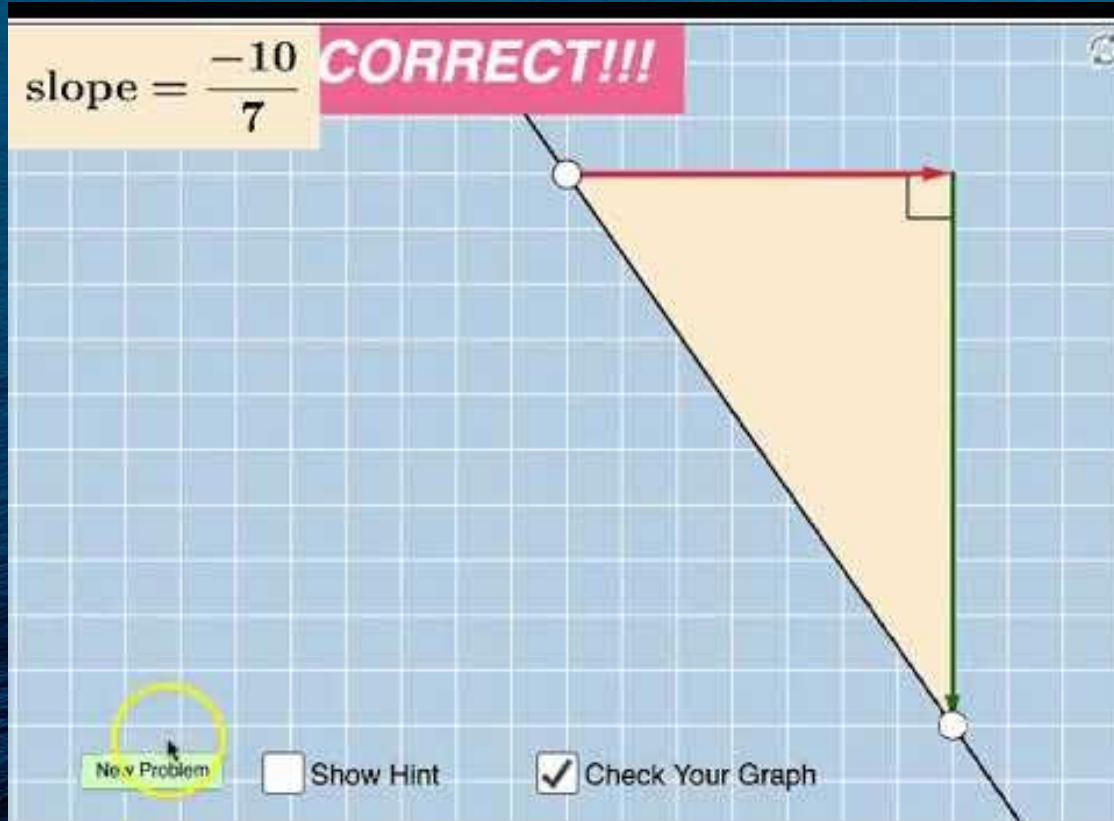
Exercises with Feedback

Endless New Problems to solve

Feedback in Real Time



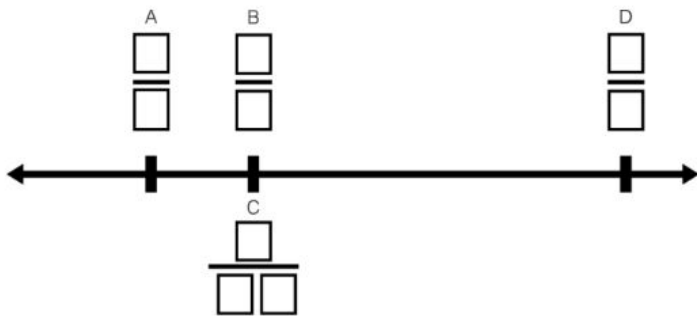
Exploration with hints



Open Middle Exercises with immediate feedback

Your task:

Directions: Using the digits 1 to 9 exactly once, place a digit in each box to create and place 4 fractions on the number line in the correct order. (fractions B & C are equal)



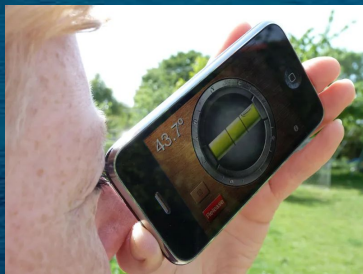
$$\square + \square = \square - \square$$

1	2	3	4	
5	6	7	8	9

Check!



Measuring and modeling height



Find the height of the Light Pole

- Step 1: Select your (approximate) height using the slider.
- Step 2: Set up a proportion using your height and the shadows given.
- Step 3: Solve for the height of the light pole.

Find the height of the Light Pole

Height of Person = 4

Light Pole's Shadow

Person's Shadow

How would you measure the height of this tree?

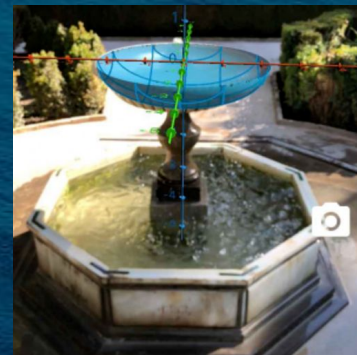
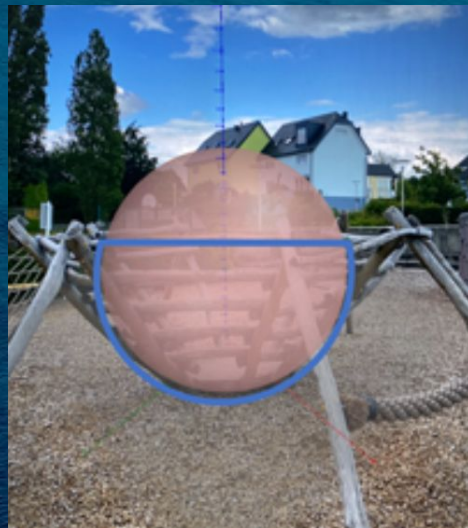
1.7m to eye Level

- Start
- Altitude
- Clinometer
- Work

$$\tan 30.41^\circ = \frac{h}{17.52}$$
$$17.52 \times \tan 30.41^\circ = h$$
$$h = 10.29 \text{ m}$$

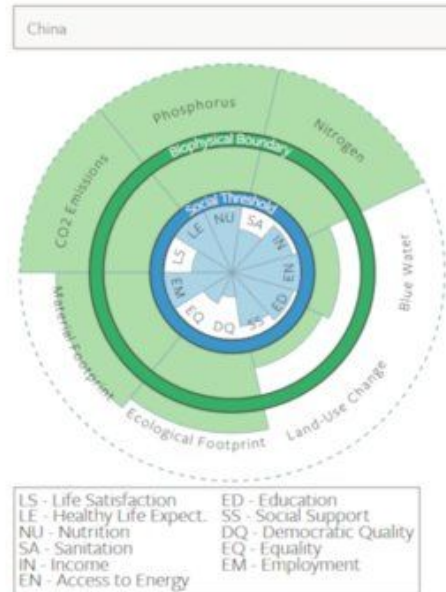
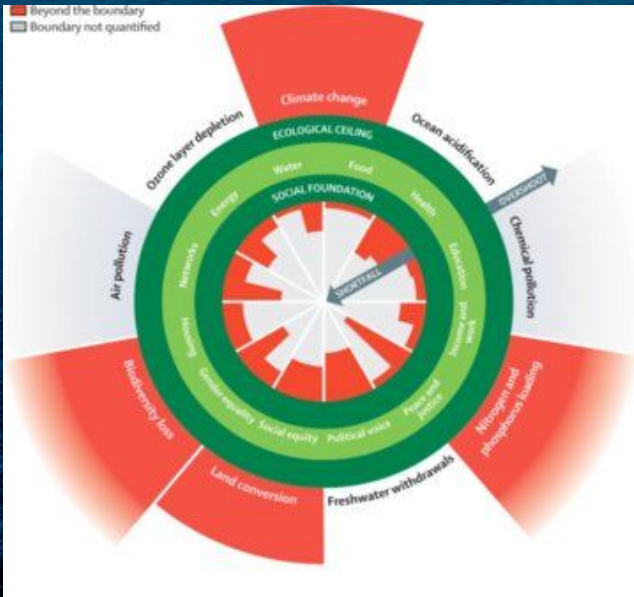
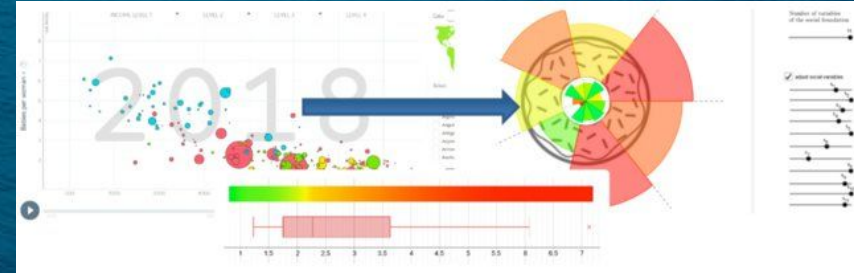
Height of Tree = 10.29 + 1.7m = 11.99m

Modeling architecture and measuring volume



Augmented Reality in GeoGebra 3D

Discovery exploration with GapMinder, GeoGebra and Observable



Open exploration

The image shows the GeoGebra Calculator Suite Graphing interface. The top bar includes the GeoGebra logo, "Calculator Suite", a "Graphing" dropdown menu, and a "SIGN IN" button. The left sidebar contains navigation icons for Algebra, Tools, and Table, along with a list of tool categories: Basic Tools, Edit, Media, Measure, Transform, and Construct. The main workspace is a coordinate grid with x and y axes ranging from -8 to 8. A settings gear icon is located in the top right corner of the grid area. In the bottom right corner, there are three circular icons: a magnifying glass for search, a magnifying glass with a plus sign for zoom in, and a square with a plus sign for zoom out.

GeoGebra Calculator Suite Graphing

Algebra

Tools

Table

Basic Tools

- Move
- Point
- Slider
- Intersect
- Extremum
- Roots
- Best Fit Line

Edit

- Select Objects
- Move Graphics View
- Delete
- Show / Hide Label
- Show / Hide Object

Media

- Image
- Text

Measure

- Angle
- Distance or Length
- Area

Transform

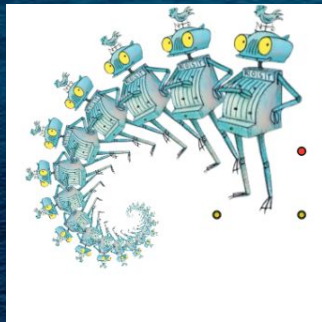
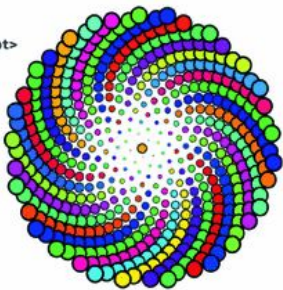
- Reflect about Line
- Reflect about Point
- Translate by Vector

Construct

CindyJS - script based

```
<!DOCTYPE html>
<html>
  <head>
    <title>Sunflower</title>
    <script type="text/javascript" src="Cindy.js"></script>
  </head>
  <body>
    <script id='csmove' type='text/x-cindyscript'>
      repeat(500,1,
        w=1*pi/180*(137.508+0.x*0.5);
        p=A+(cos(w),sin(w))*0.3*sqrt(i);
        draw(p,size->sqrt(i)*.4,color->hue(i/34));
      );
    </script>
    <script type="text/javascript">
      var gslp=[ {name:"A", kind:"P", type:"Free", pos:[0,0]},
        {name:"B", kind:"P", type:"Free", pos:[0,9]}};

      createCindy({canvasname:"CSCanvas",
        movescript:"csmove",
        geometry:gslp});
    </script>
    <canvas id="CSCanvas" width=500 height=500/>
  </body>
</html>
```



수학문제 시각화 05

CindyJS

를 활용한 수학적 모델링

최경식 지음

Simulation Algorithms

Geometry

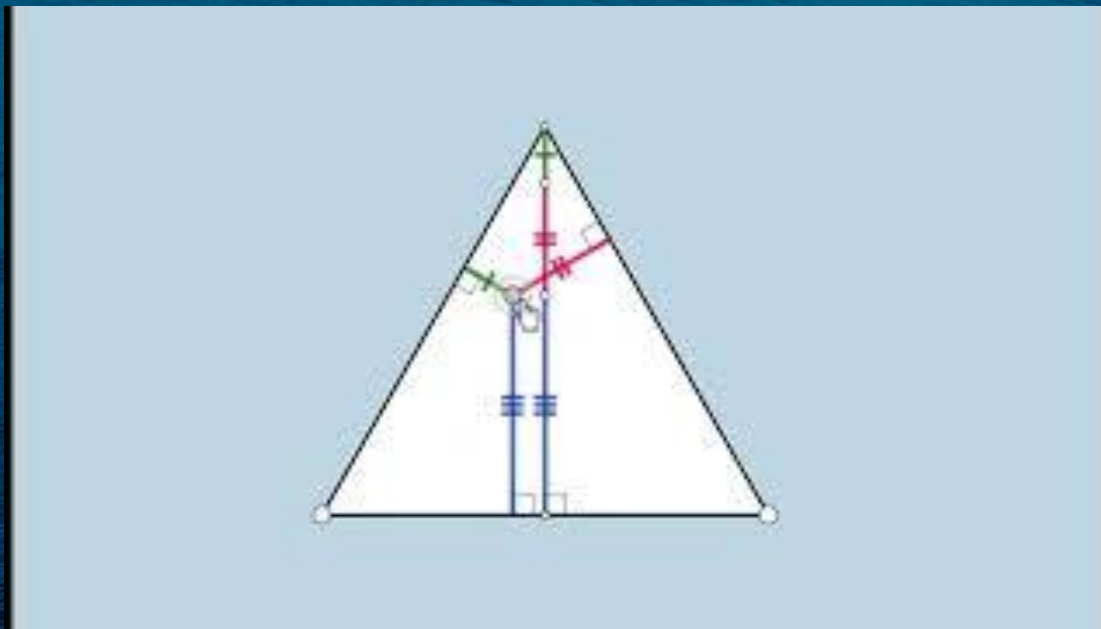
지오록스

Silent Video Tasks

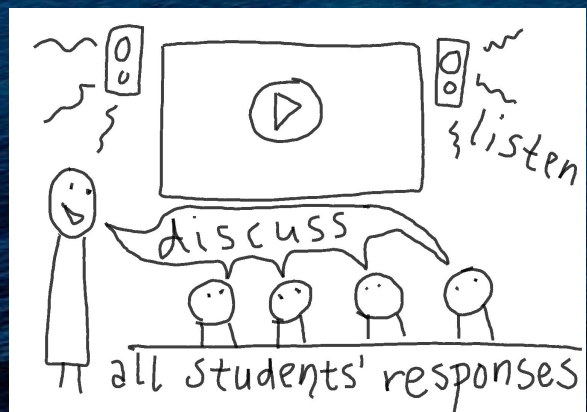
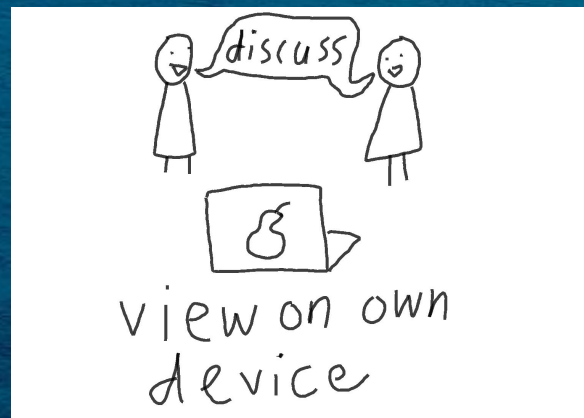
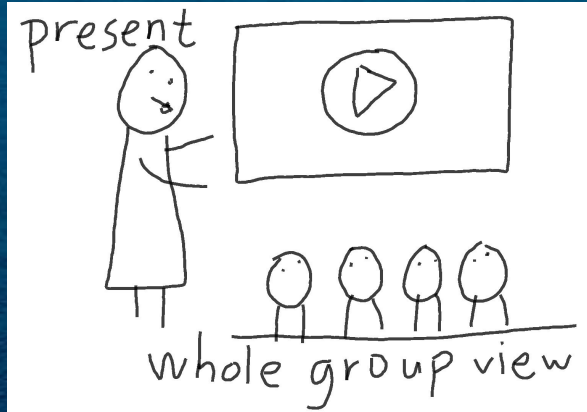
What do I notice?

What do I wonder?

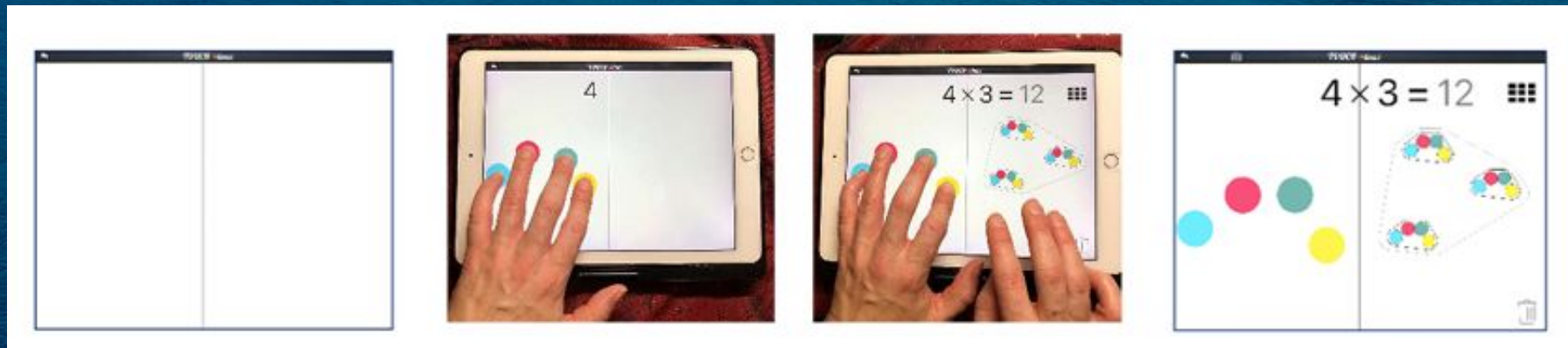
How would I describe, explain or narrate this for my peers?



Silent Video Task Implementation



Exploration with TouchTimes and TouchCounts



App Store Preview

Nathalie Sinclair

iPad

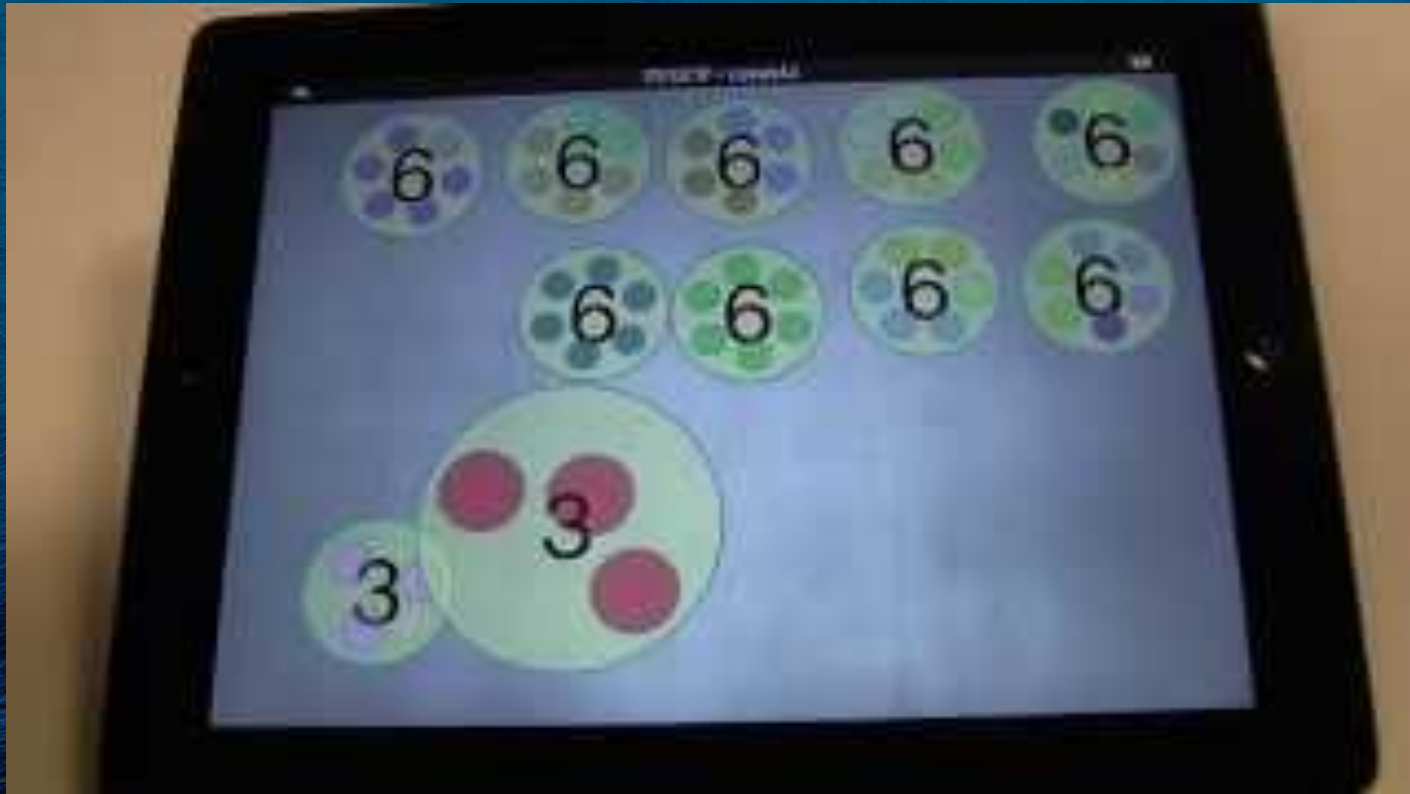


TouchTimes
Education



TouchCounts
Education

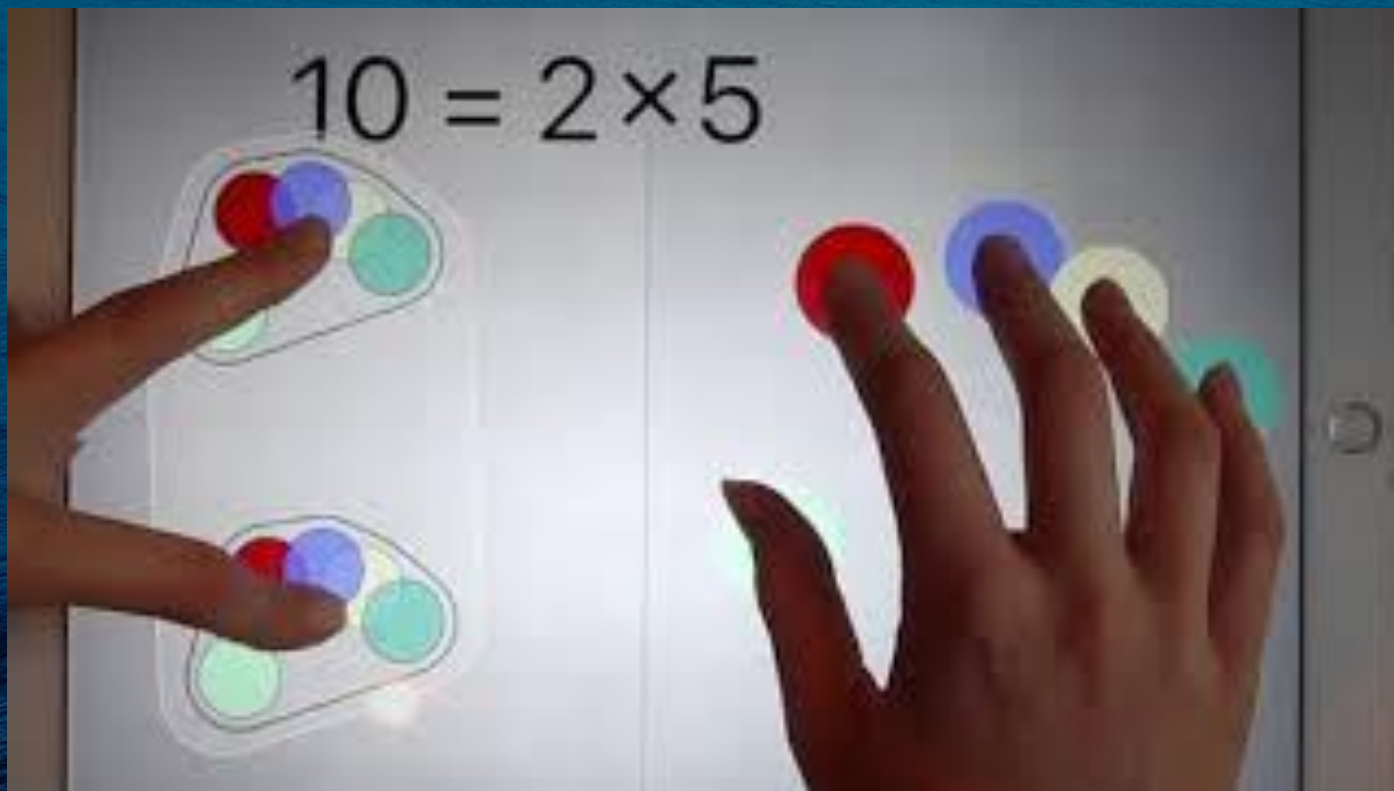
Counting and combining in TouchCounts



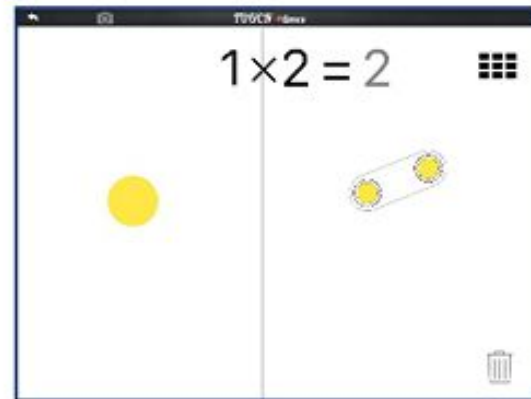
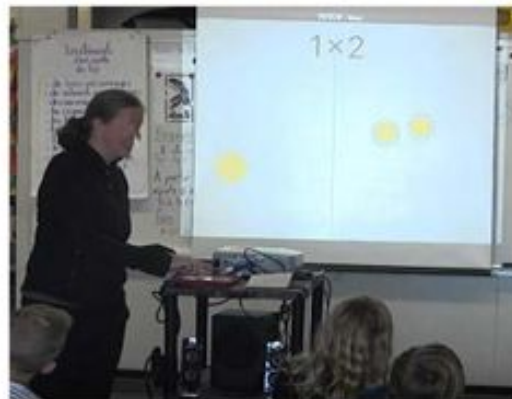
Exploring 7s in TouchCounts



Exploration TouchTimes

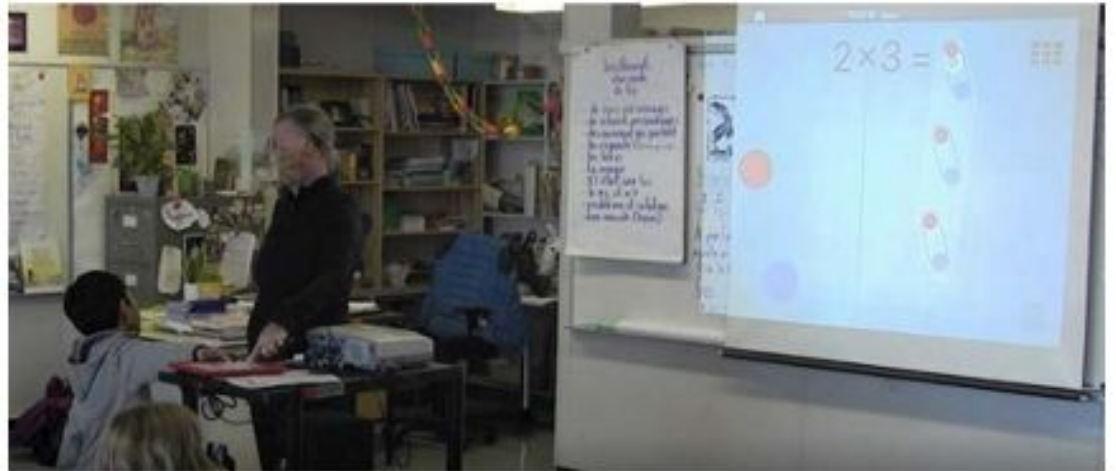


“I would like you to check what happens when..”



Teacher showing the possibilities of TouchTimes using a projector

Students show their work



By drawing (small whiteboards)

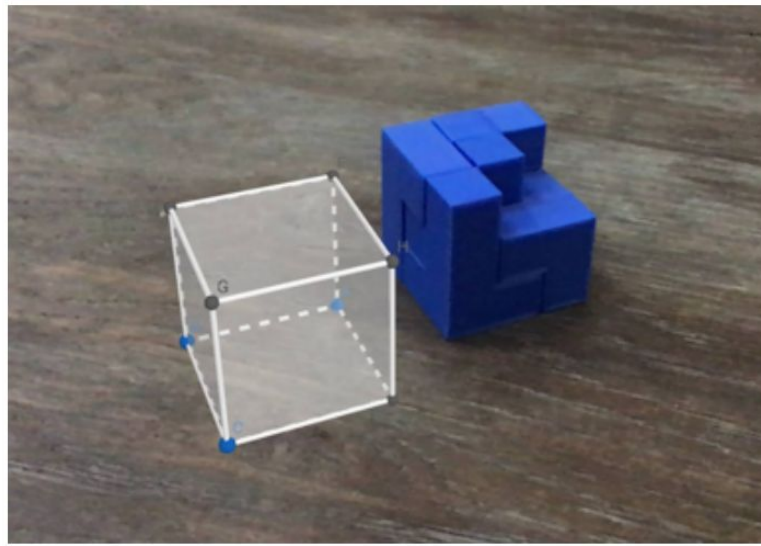
By displaying (using the tablet)

Teacher displays and students explain

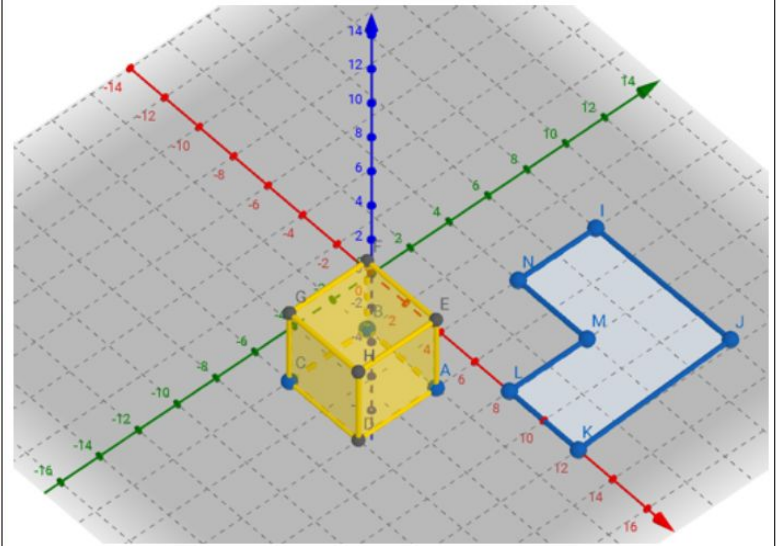


What do you notice? Point to screen and explain "I notice that..."

Bridge between digital and physical models

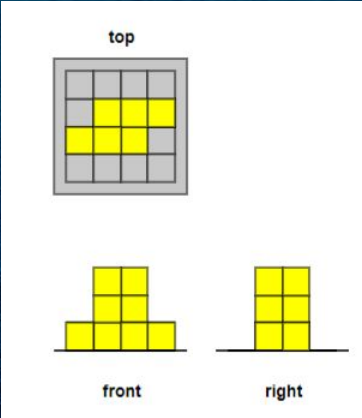
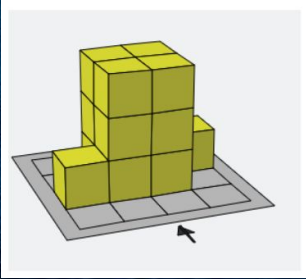
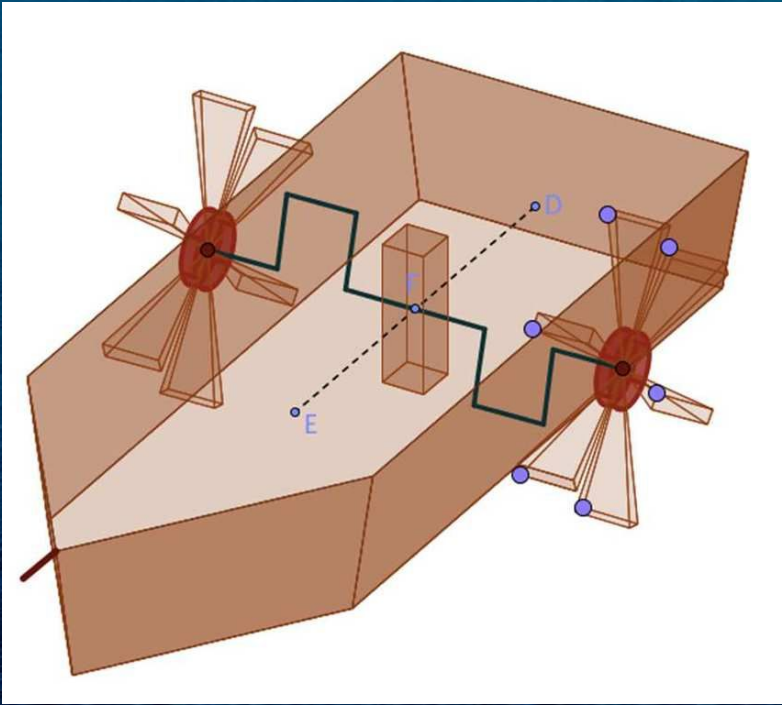


Augmented reality

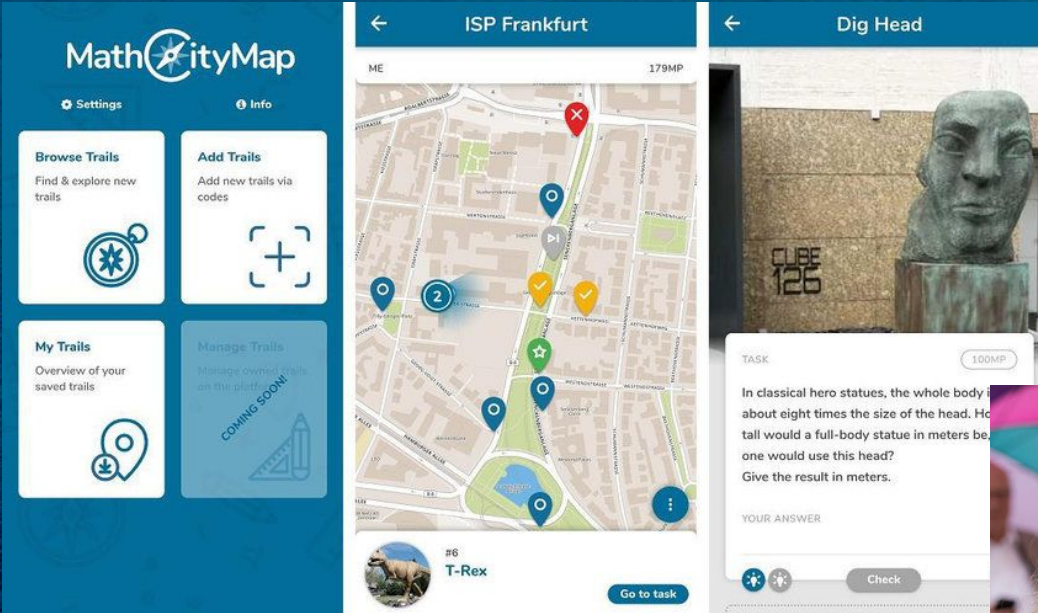


Digital 3D model

Modeling - connecting digital and physical models



Outdoor Activities



Math Paths in the Neighbourhood

Scratch - Block Based Coding

The image shows the Scratch web interface. At the top, there is a navigation bar with the Scratch logo, a settings gear, and menu items: Settings, File, Edit, Share, See Project Page, Tutorials, and User. Below this is a secondary bar with tabs for Code, Costumes, and Sounds. The main workspace is split into three sections. On the left is a 'Code' sidebar with a 'Motion' category selected, showing a list of motion blocks: 'move 10 steps', 'turn 15 degrees', 'turn 15 degrees', 'go to random position', 'go to x: 0 y: 0', 'glide 1 secs to random position', 'glide 1 secs to x: 0 y: 0', 'point in direction 90', 'point towards mouse-pointer', and 'change x by 10'. The center is the 'Stage' area, which is a white grid with a Scratch cat sprite in the middle. On the right is a 'Sprite' and 'Stage' control panel. The 'Sprite' panel shows 'Sprite 1' selected, with its position (x: 0, y: 0) and direction (90) displayed. The 'Stage' panel shows 'Backdrops 1'. At the bottom of the interface, there is a 'Backpack' label.

Snap - Block Based Coding



Build Your Own Blocks

A screenshot of the Snap! programming environment. The interface is divided into several sections: a left sidebar with category menus (Motion, Control, Looks, Sensing, Sound, Operators, Pen, Variables), a central workspace with a script area containing blocks like 'when clicked', 'clear', 'pen up', 'go to x: 0 y: -150', 'pen down', 'point in direction', and 'vee'; a 'Method Editor' dialog box in the foreground with a 'vee' block containing 'turn 20 degrees', 'move 25 steps', 'run Item random of shapes', 'move 25 steps', 'turn 40 degrees', 'move 25 steps', 'run Item random of shapes', 'move 25 steps', and 'turn 20 degrees'; and a right panel with a 'shapes' list (square, hex, star, vee, vee) and a drawing of a tree with various shapes at its branches. The bottom of the screen shows a 'Sprite' area with a 'Sprite' icon and a 'Stage' area.

Measurements and free design - TinkerCAD & GeoGebra



Overview in the GeoGebra Classroom



GeoGebra Classroom

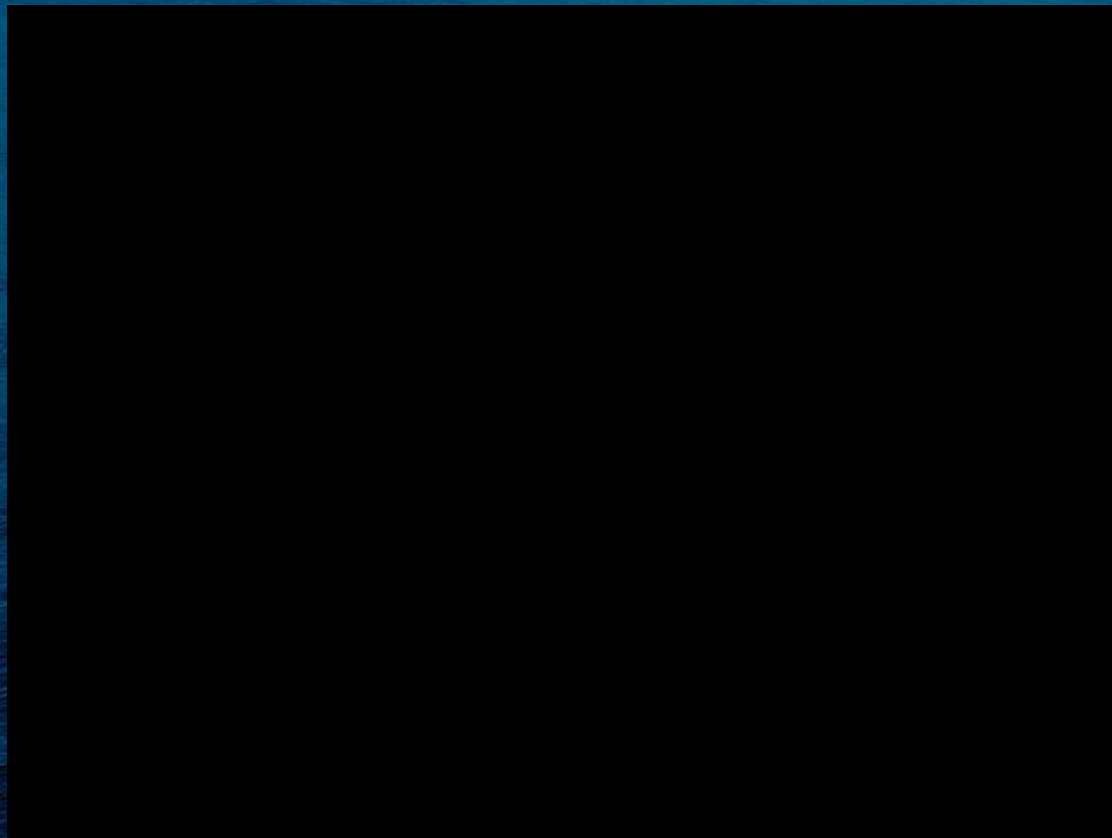


GeoGebra

GeoGebra Classroom
More New Features!



Desmos simulated probability experiments



See what students do in real time - use as basis for discussions

A screenshot of a virtual classroom interface. At the top, there is a navigation bar with 10 numbered tabs: 1 Let's pla..., 2 Practice, 3 Practice, 4 36 Round..., 5 Class Re..., 6 Probabil..., 7 A New S..., 8 Create Y..., 9 36 Round..., 10 Settle a... The main area displays a 3x3 grid of student avatars. The avatars in the first row are Hertha Ayrtou, Hermann Grass..., and Vivienne Melon... The avatars in the second row are Adrian Scott Du..., Liu Hui, and Ismail Mustafa a... The avatars in the third row are partially visible. A video feed of a student with glasses is visible in the bottom right corner.

A screenshot of a virtual classroom interface showing a probability scale and student comments. The scale is a horizontal line from 0 to 1, with labels: Impossible, Less Likely, Equally Likely, More Likely, Certain. A red dot is placed at 3/4, labeled "Lands on RED". A blue dot is placed at 1/4, labeled "Lands on BLUE". The "Equally Likely" label is circled in yellow. Below the scale, there are student comments:

Then explain your thinking.

Gottfried Leibniz
Red covers 3/4 of the pie chart, and "More Likely" is 3/4 on the scale. Blue covers 1/4 of the pie chart, and "Less Likely" is 1/4 on the scale.

Mary Cartwright
because of reds giant surface area compared to blue its triple the chance

Moon Duchin
Red is covering 3/4 of the spinner and blue is covering 1/4 of the spinner.

Jesse Wilkins Jr.
It is not certain to land on red but

A video feed of a student with glasses is visible in the bottom right corner.

Connected Classroom of Desmos

desmos

Intro to Desmos Activities

Kathy Henderson

✉ support@desmos.com

🐦 [@desmos](https://twitter.com/desmos)



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✉ support@desmos.com

🐦 [@desmos](https://twitter.com/desmos)



Thank you for your
attention,
I will explain the next
activities and
I hope you enjoy the
conference!



Link to slides:
tiny.cc/DTBea

We are going to do
some StreetMath!



After StreetMath you will need MathCityMap !

After Streetmath, you need the App *MathCityMap*

It's free and GDPR-compliant



Google Play



MathCityMap

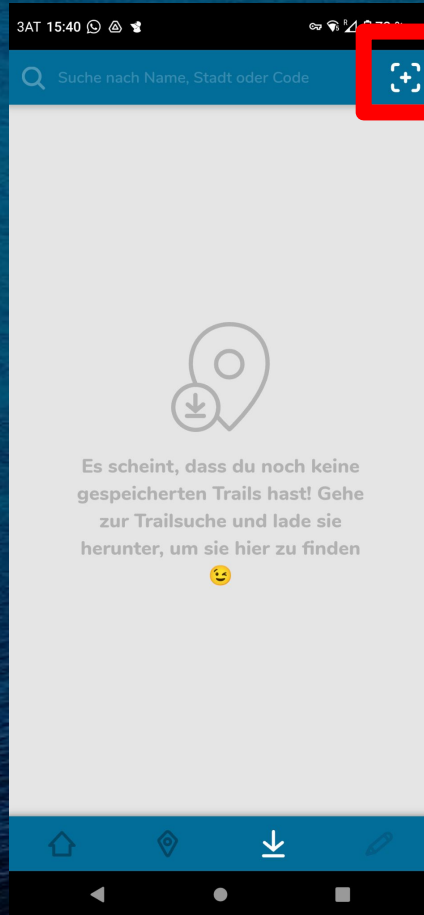


App Store

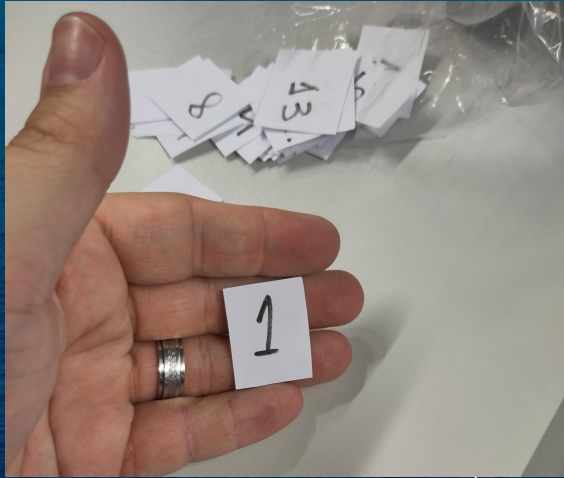
For later:



MathCityMap



What happens now



Everyone gets
a number



Groups of 3:
1 Phone



MathCityMap

Streetmath



Keep the number - it's
your group and first task
number!

References

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