

Slide Zero

- sit with a partner.
- share a computer.

GeoGebra: From Construction to Abstraction

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www.scottfarrar.com/southbay2017/

don't skip ahead please ;)

#

Construct, Demo, Manipulate

1 Diagonals Cut Each other

1. Go to the page
2. What do you notice?
What do you wonder?



www.geogebra.org/m/WxhmrA3H

Construct, Demo, Manipulate

2 <https://www.geogebra.org>

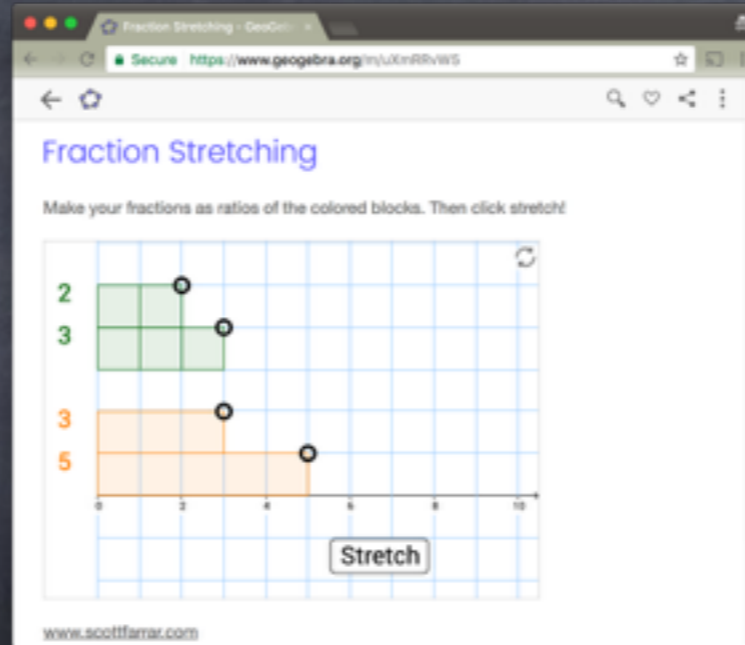
3. Download GeoGebra

4. Make a shape that
always...



Construct, Demo, Manipulate

3



<https://www.geogebra.org/m/uXmRRvW5>

think pair share... what can GeoGebra do? what are things you are less sure about?

Construct, Demo, Manipulate

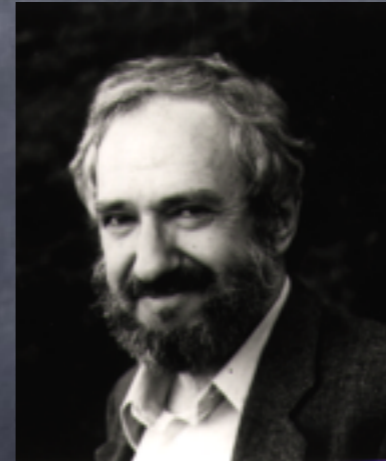
(order varies)

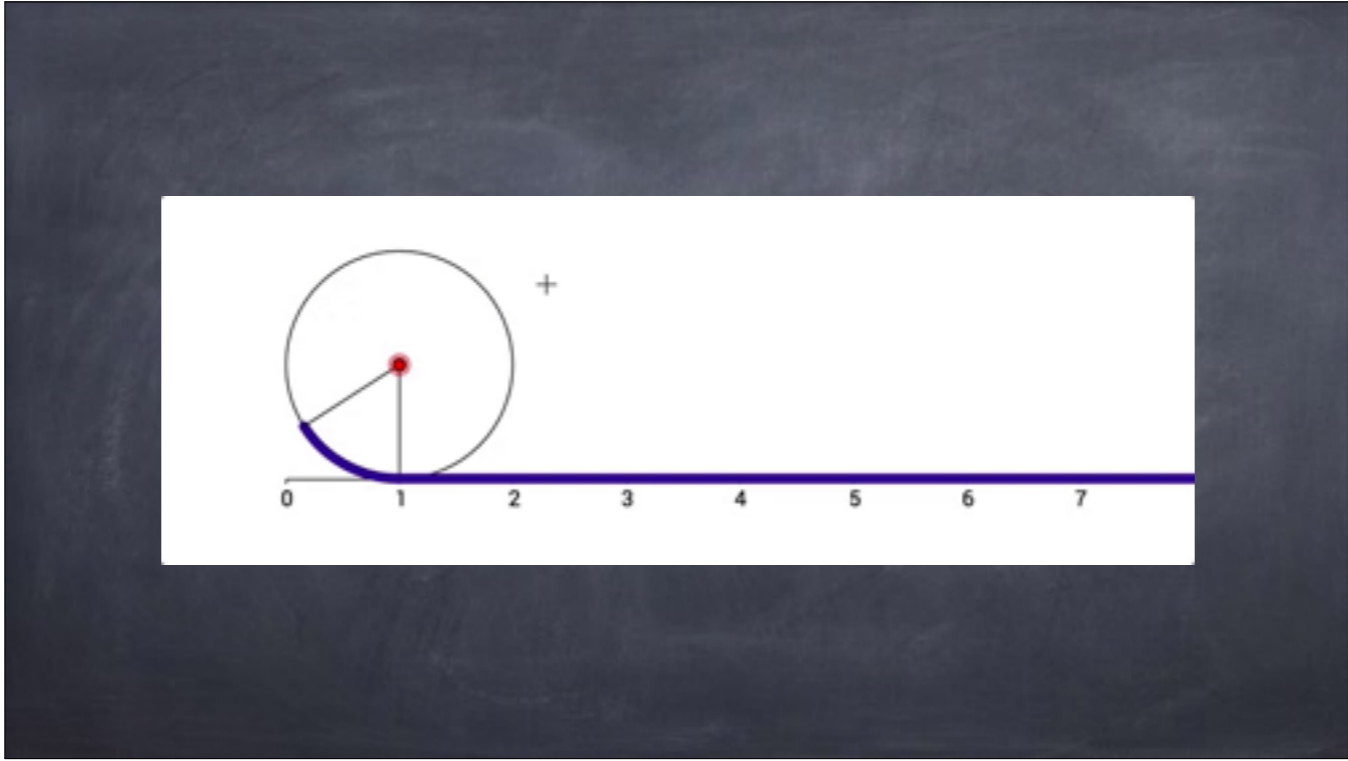
(ok lids down please)

What kind of learning is supported?

“The computer can
concretize and
personalize the formal.”

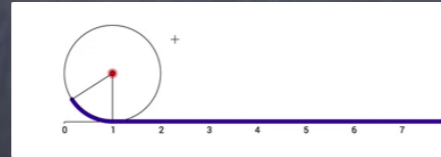
Seymour Papert





Which is

Concrete



Formal / Abstract

One radian is the angle subtended at the center of a circle by an arc that is equal in length to the radius of the circle.

Which is

6th grade standard SP.B.4

- Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

Concrete

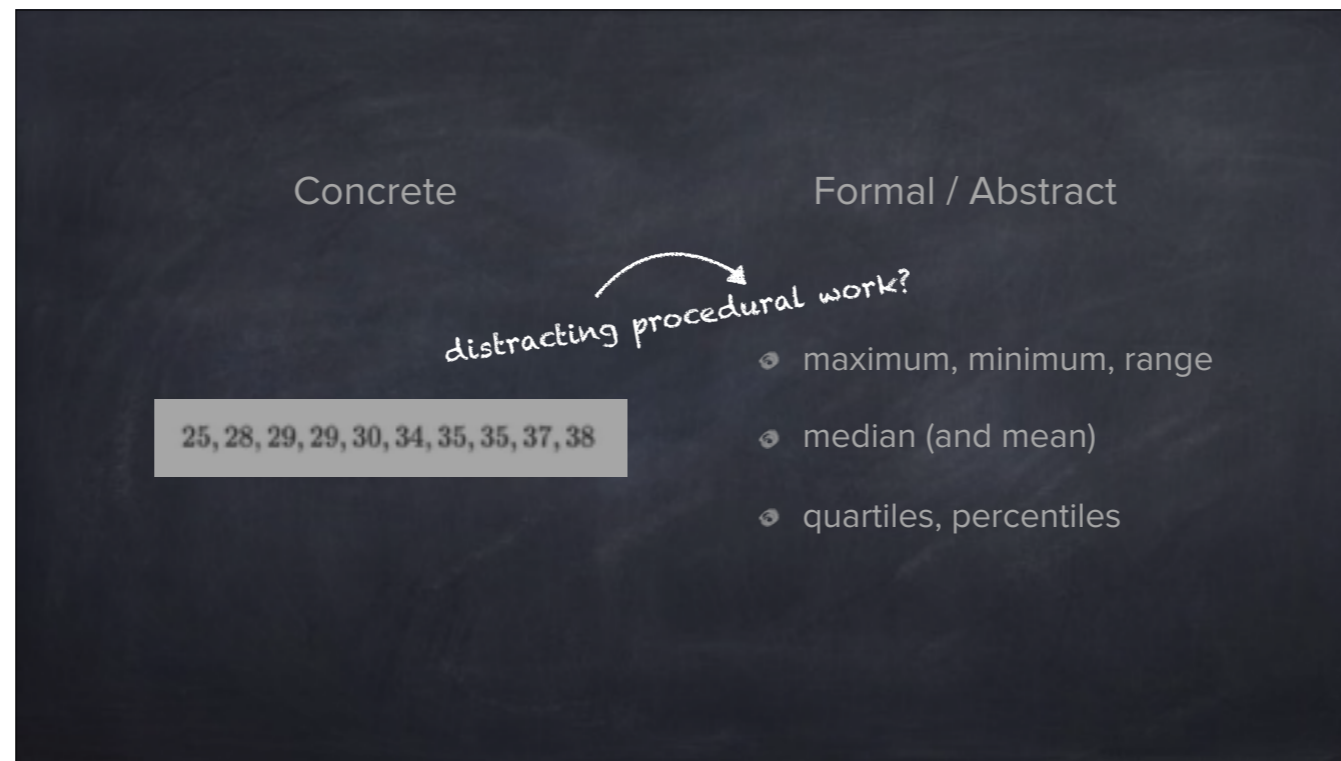
25, 28, 29, 29, 30, 34, 35, 35, 37, 38

Formal / Abstract

- maximum, minimum, range
- median (and mean)
- quartiles, percentiles

These are formal concepts to work with.

Arithmetic struggles may interfere with access to the concept.



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Arithmetic struggles may interfere with access to the concept.

GeoGebra as a scaffold

25, 28, 29, 29, 30, 34, 35, 35, 37, 38

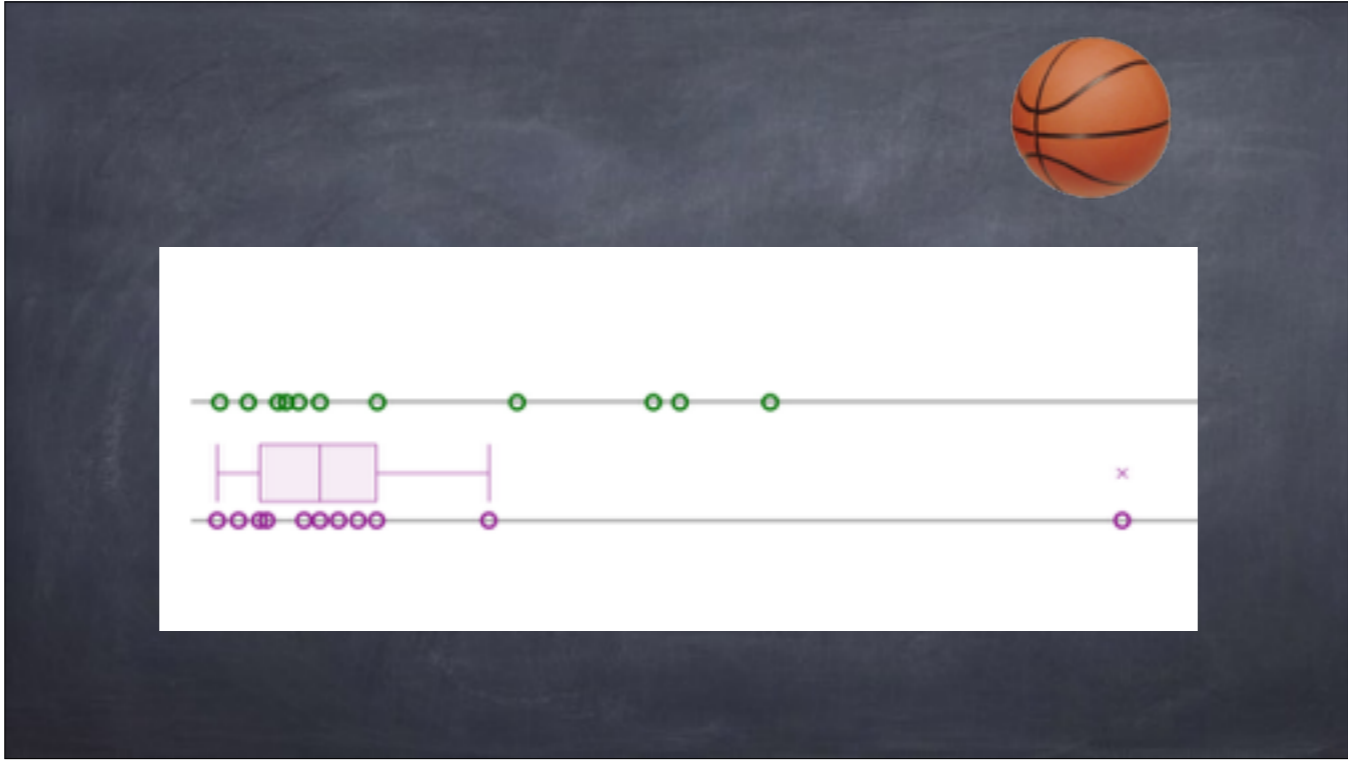
The task of making a box plot can get in the way of reaching towards the abstract concepts of descriptive statistics...

So lets skip the numbers.

Who had a better season?

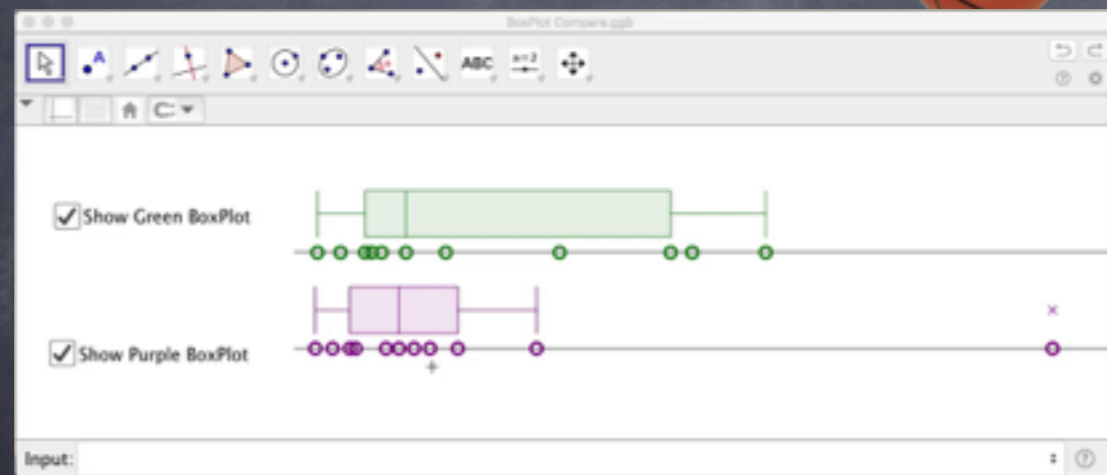


George and Paula's basketball points



What does this tool tell us?

4



<https://www.geogebra.org/m/asxFygjx>

Concrete

“Computer manipulatives
provide unique affordances
for the development of
integrated-concrete
knowledge.”

Sarama, Julie, and Douglas H. Clements. “‘Concrete’ Computer Manipulatives in Mathematics Education.” *Child Development Perspectives* 3, no. 3 (December 1, 2009): 145–50. doi:10.1111/j.1750-8606.2009.00095.x.

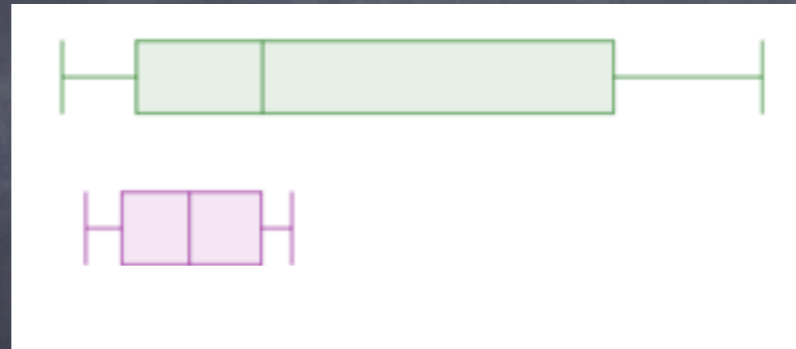
Concrete

“Computer manipulatives provide unique affordances for the development of integrated-concrete knowledge.”

“concrete at a higher level”
It is connected to knowledge abstracted from the physical and one’s existing knowledge framework

Sarama, Julie, and Douglas H. Clements. “‘Concrete’ Computer Manipulatives in Mathematics Education.” *Child Development Perspectives* 3, no. 3 (December 1, 2009): 145–50. doi:10.1111/j.1750-8606.2009.00095.x.

Concrete at a higher level



These were objects the students tinkered with, they had a dozen minute interactions with— each interaction asking and answering an unvoiced or even unconscious question.

What kind of learning is supported?

Students are supported in treating the abstract as concrete

We bridged student reasoning from points on a line to the box plot, then

Digital Affordances

Sarama and Clements (2009)

- Bringing math ideas to conscious awareness
- Encouraging and facilitating complete precise explanations
- Supporting mental “actions on objects”
- Changing the nature of the manipulative
- Symbolizing mathematical concepts
- Linking the concrete and symbolic with feedback
- Recording and replaying student actions



Sarama, Julie, and Clements, Douglas H. “‘Concrete’ Computer Manipulatives in Mathematics Education.” *Child Development Perspectives* 3, no. 3 (December 1, 2009): 145–50. doi:10.1111/j.1750-8606.2009.00095.x.

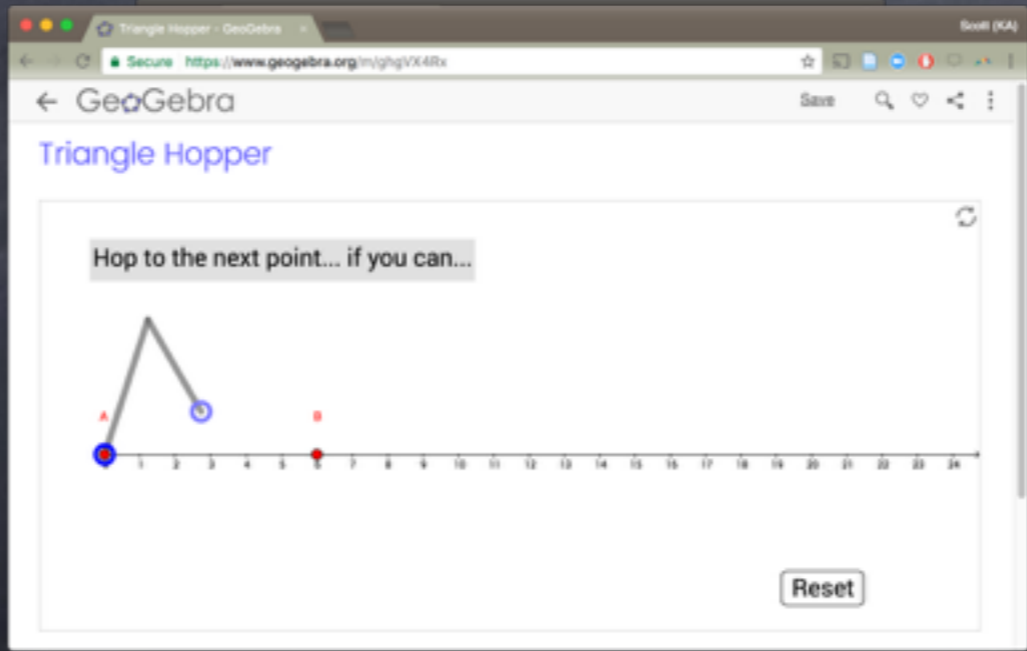
Digital Affordances of GeoGebra?

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think pair share... what can GeoGebra do? what are things you are less sure about?

5

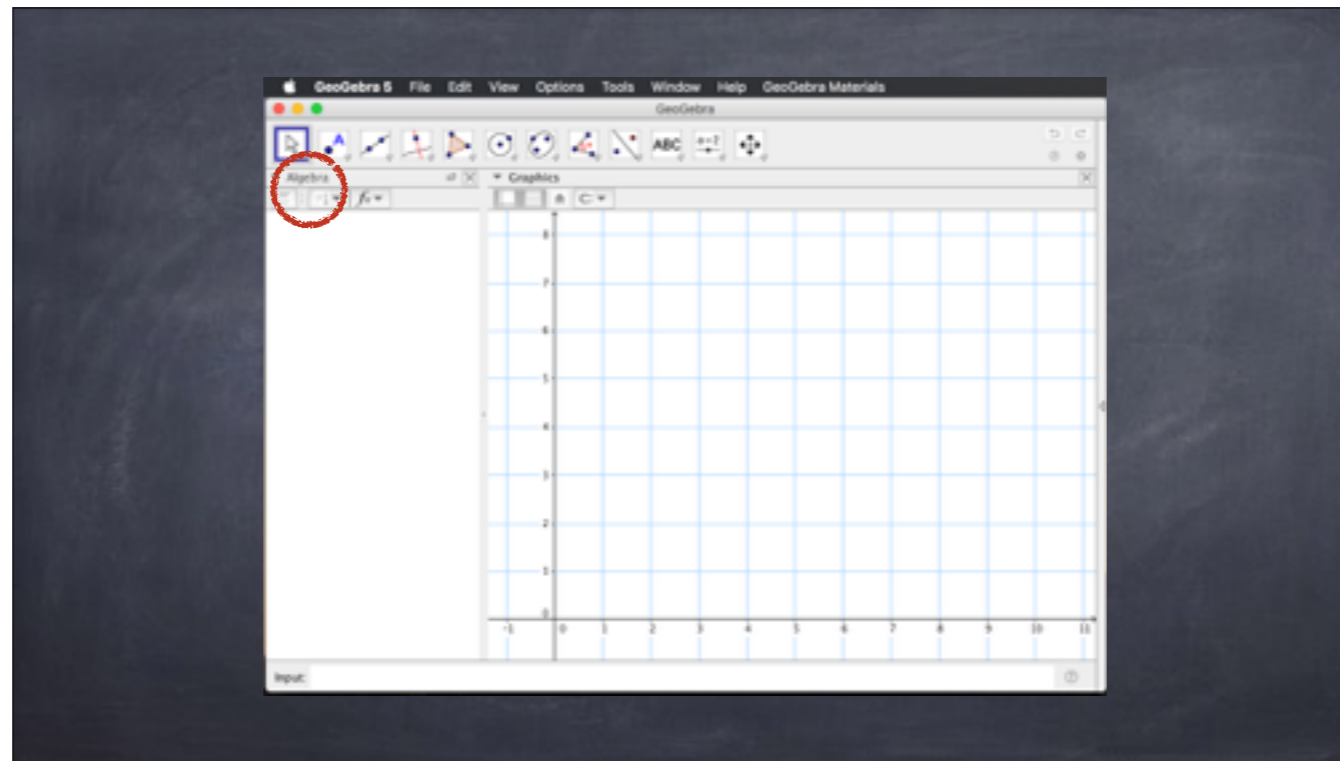


<https://www.geogebra.org/m/ghgVX4Rx>

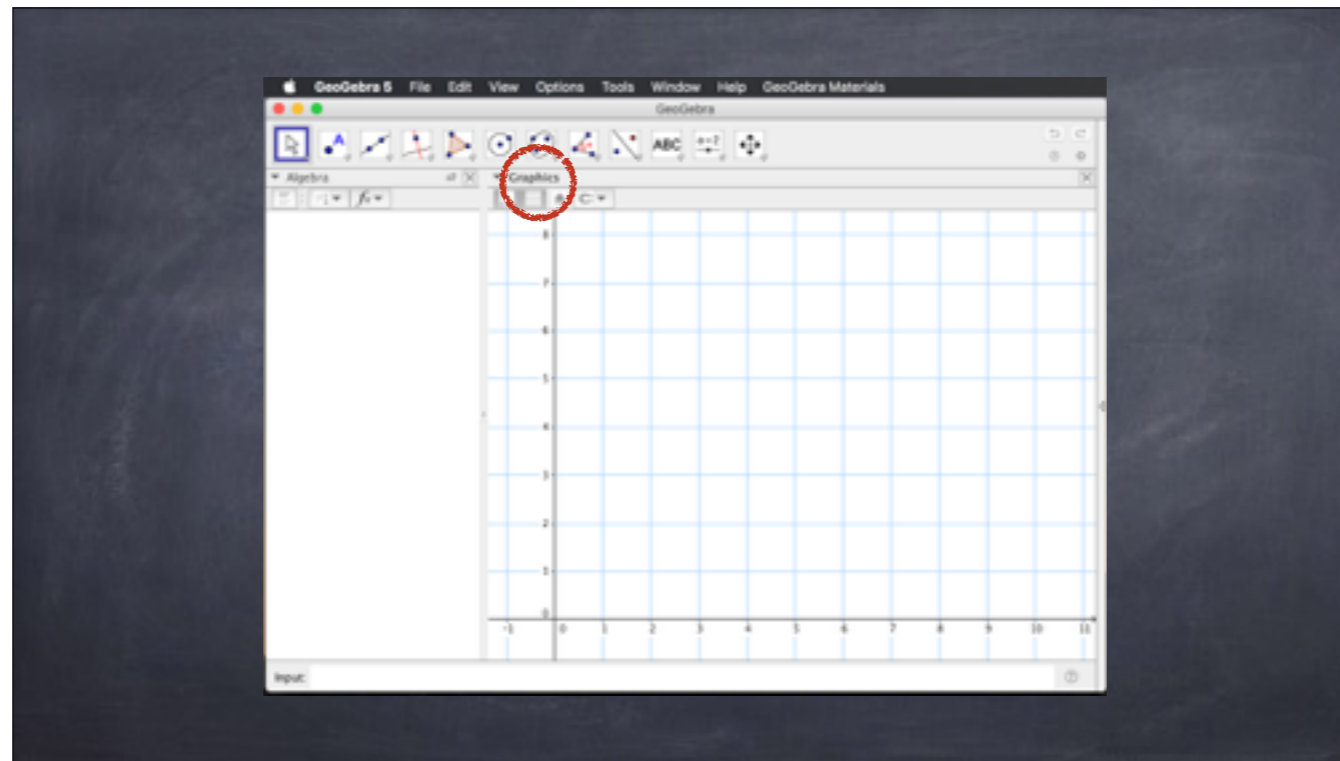
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Nuts and Bolts

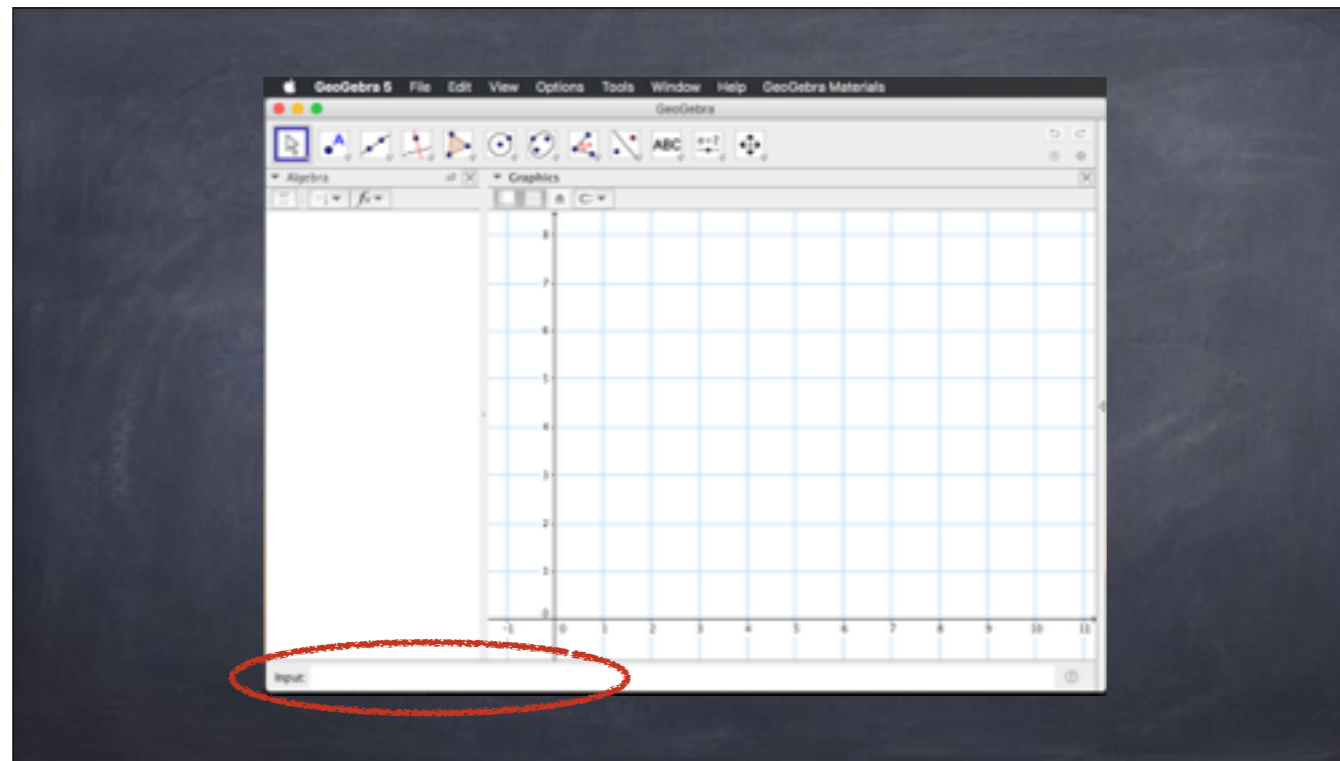
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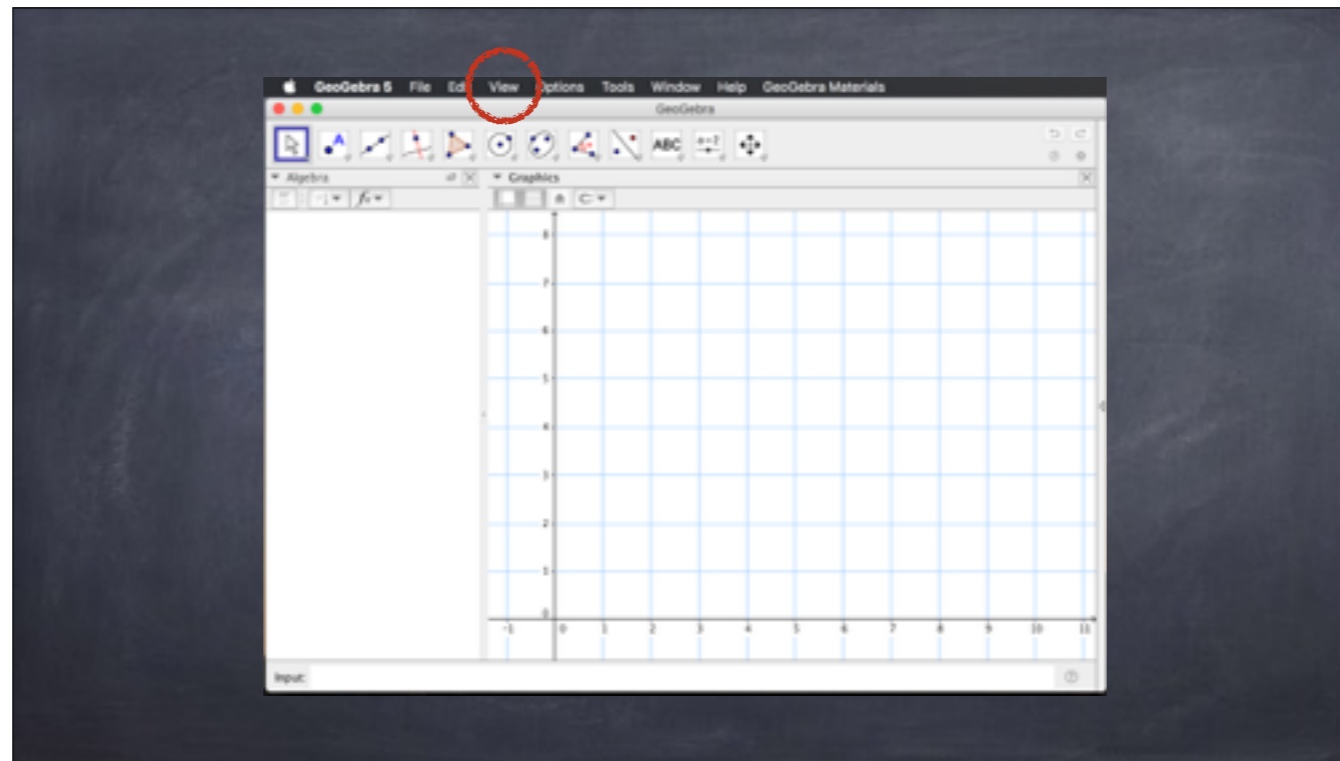
Item List, formula list



Graphics Display, Geometry display



Input Bar

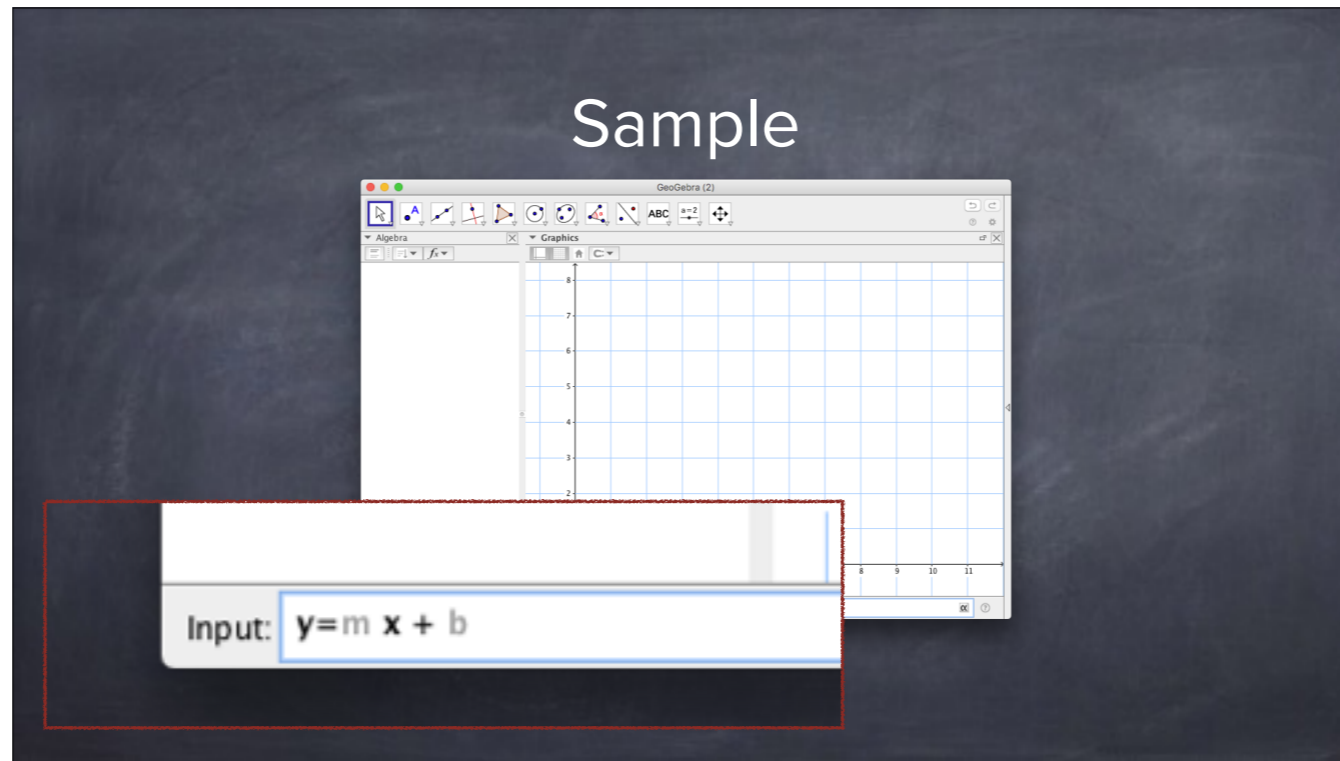


can't see one of these things?

Lets try stuff out...

We bridged student reasoning from points on a line to the box plot, then

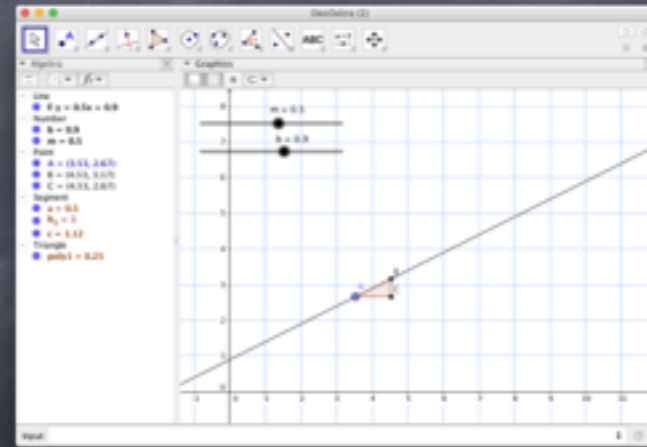
Sample



can't see one of these things?

Sample

1. Place a point on the line.
2. input $(x(A)+1, f(x(A)+1))$
3. Find a way to add point C and complete the slope triangle



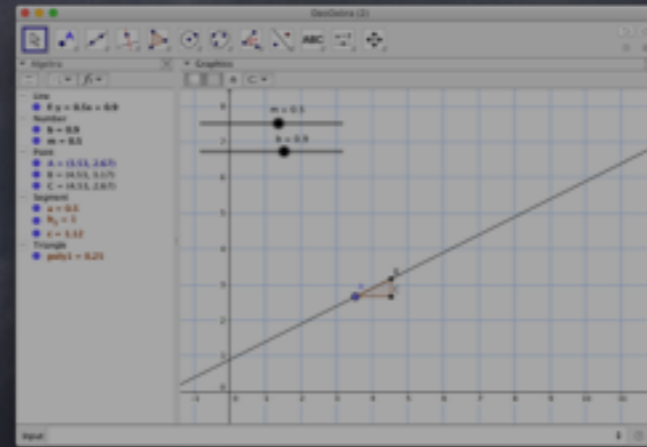
can't see one of these things?

Sample

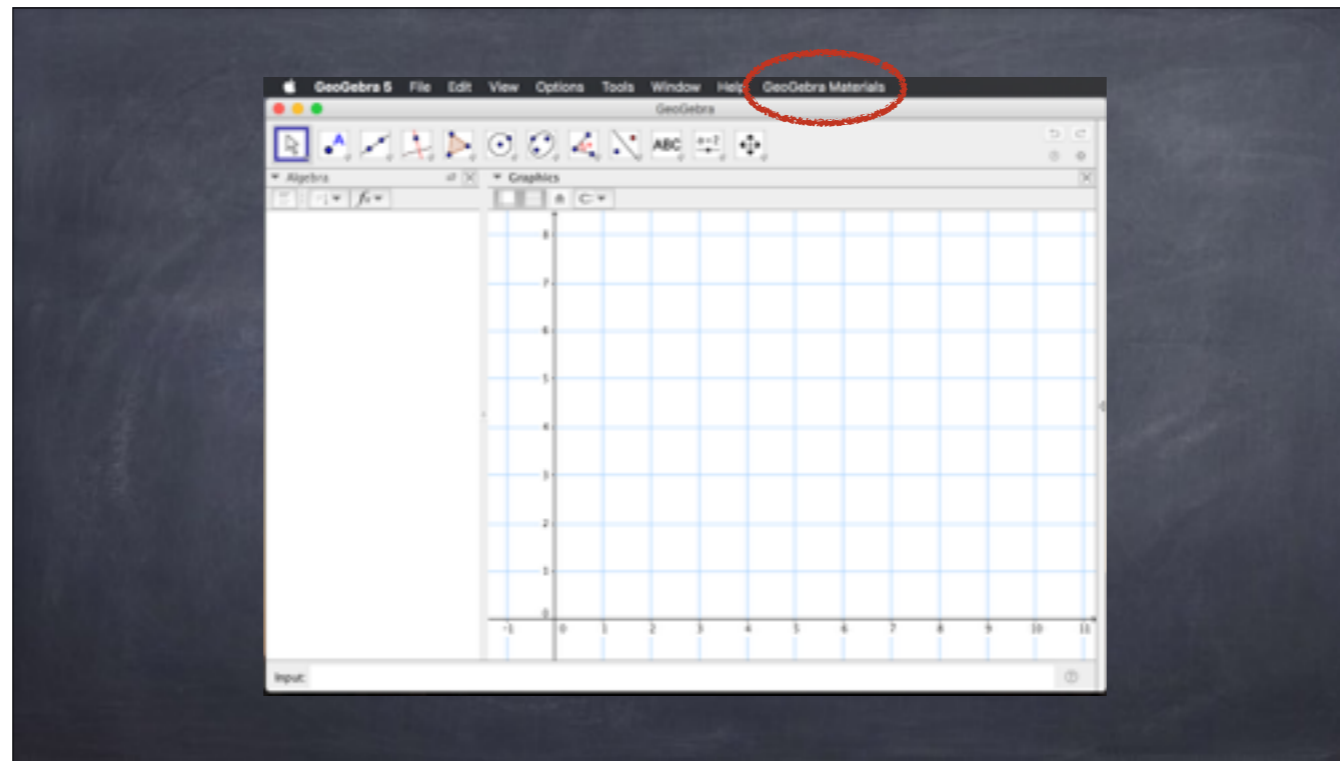
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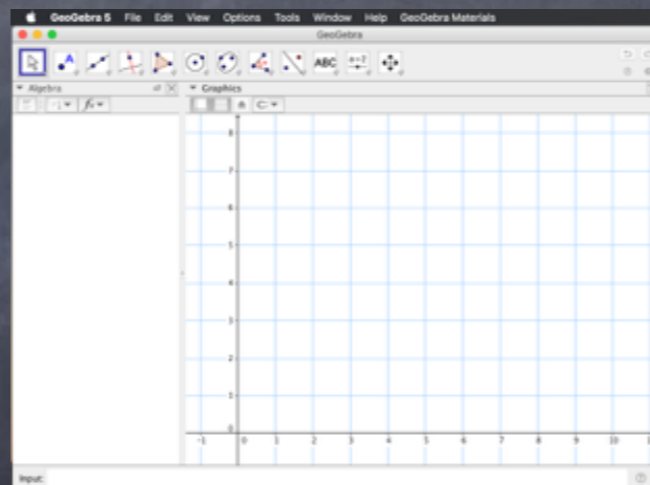
can't see one of these things?



can't see one of these things?

Construction mission

1. Construct a rectangle
2. Construct an equilateral triangle that always has the same perimeter as your rectangle.



can't see one of these things?

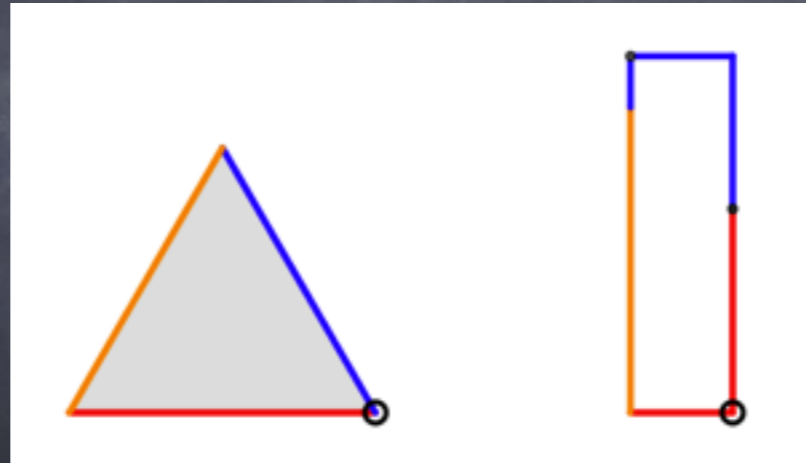
Open Workshop Time

(but we're not done yet)

We bridged student reasoning from points on a line to the box plot, then

Which has the larger area?

6

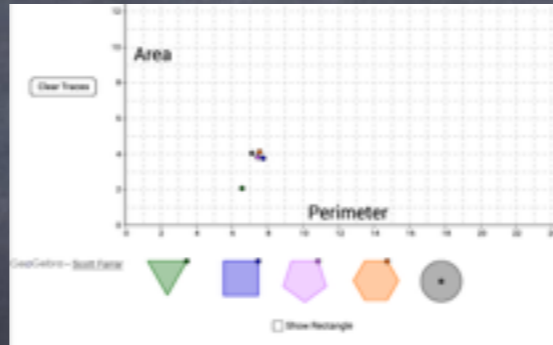


<https://www.geogebra.org/m/TbM9vCpA>

think pair share... what can GeoGebra do? what are things you are less sure about?

Perimeter v. Area

7



<https://www.geogebra.org/m/nHCUzNx>

GeoGebra

- construct, demo, manipulate
- scaffold abstraction
- tinkering: resolving unconscious questions
- a tool for thought

Q&A

www.geogebra.org

www.geogebra.org/scottfarrar

www.scottfarrar.com

Twitter @farrarscott

Thank you!

We bridged student reasoning from points on a line to the box plot, then