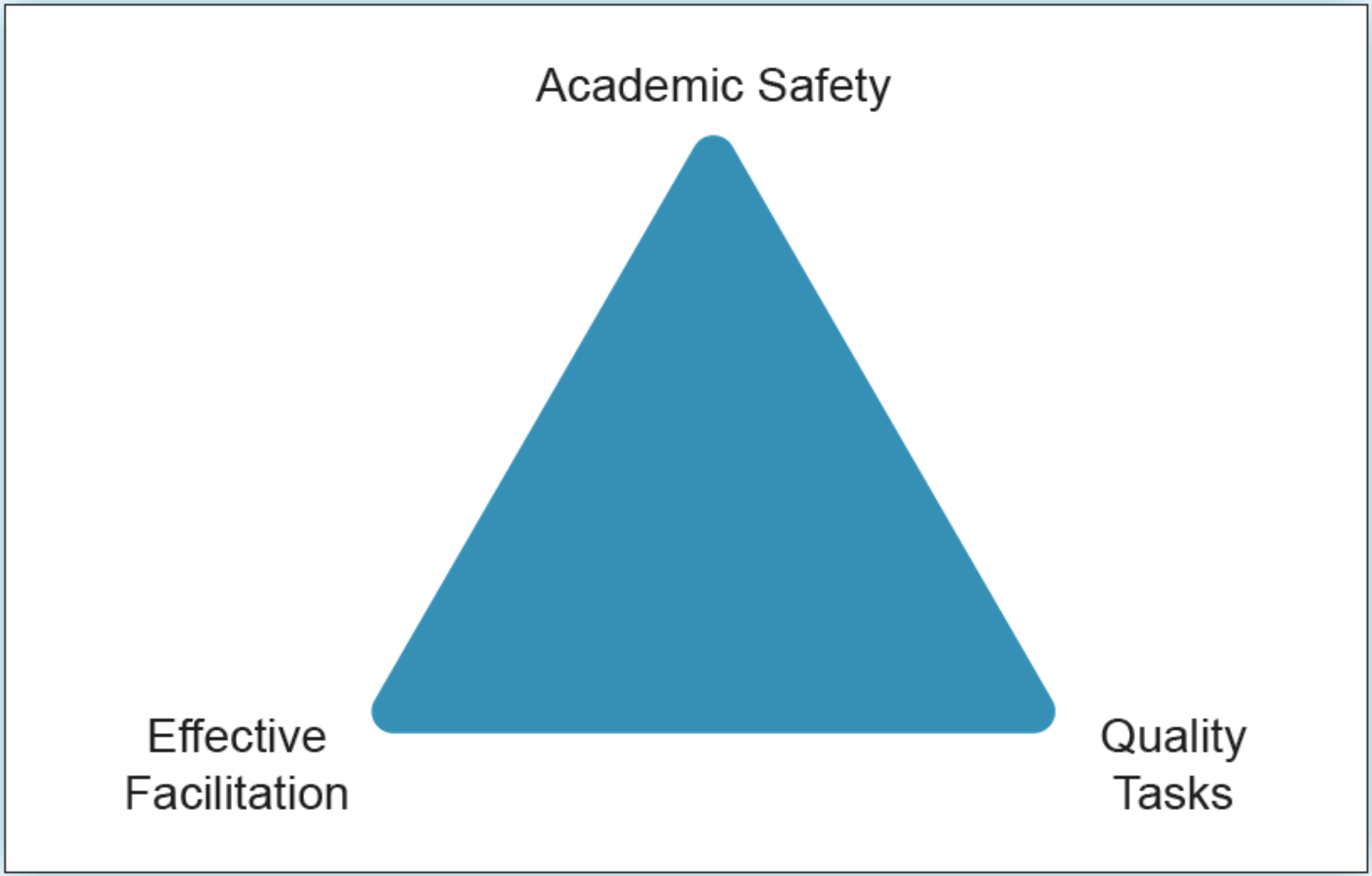
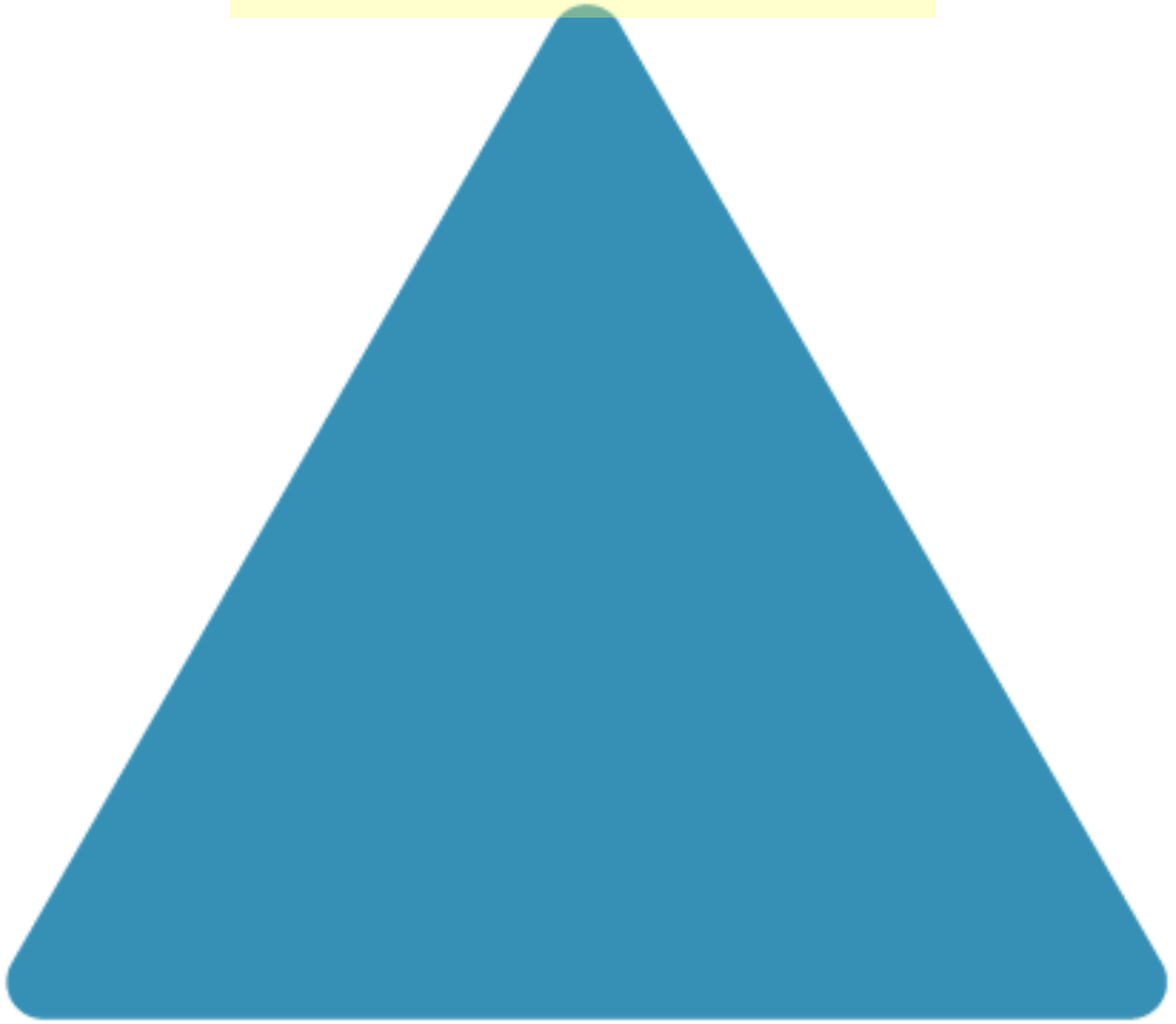
Necessary Conditions

Essential Elements for Secondary Math Learning

Geoff Krall | gmkrall@gmail.com | emergentmath.com | @geoffkrall
New Tech Network
Thursday, November 29 | 8:00am - 9:15am | 4 C4


Academic Safety
Effective Facilitation
Quality Tasks

Academic Safety



Effective Facilitation

Quality Tasks

Academic Safety = Social-emotional status + mathematical self-regard

Math Mindset & Attitudes Survey

Agree / Disagree / Neutral:

“Math is fun.”
“I think I am good at math.”
“My peers think I am good at math.”
“Math is about using the right formula.”

Discuss generally: what are your predictions for each of these statements?

Which statement do you think had the largest “agree”?
Which statement do you think had the largest “disagree”?

Agree Disagree Neutral / Not Sure

“I think I am good at math.”

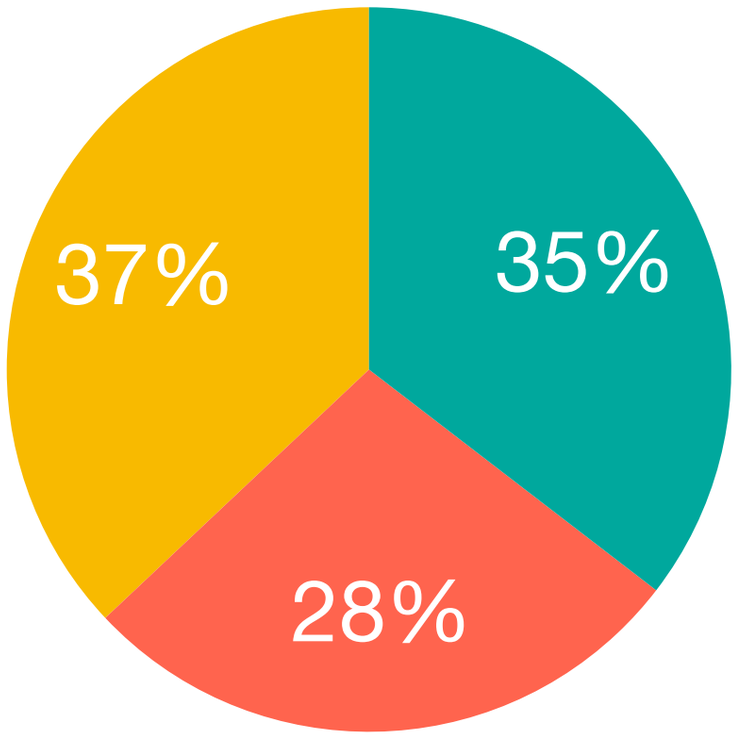
“My peers think I am good at math.”

“Math is fun.”

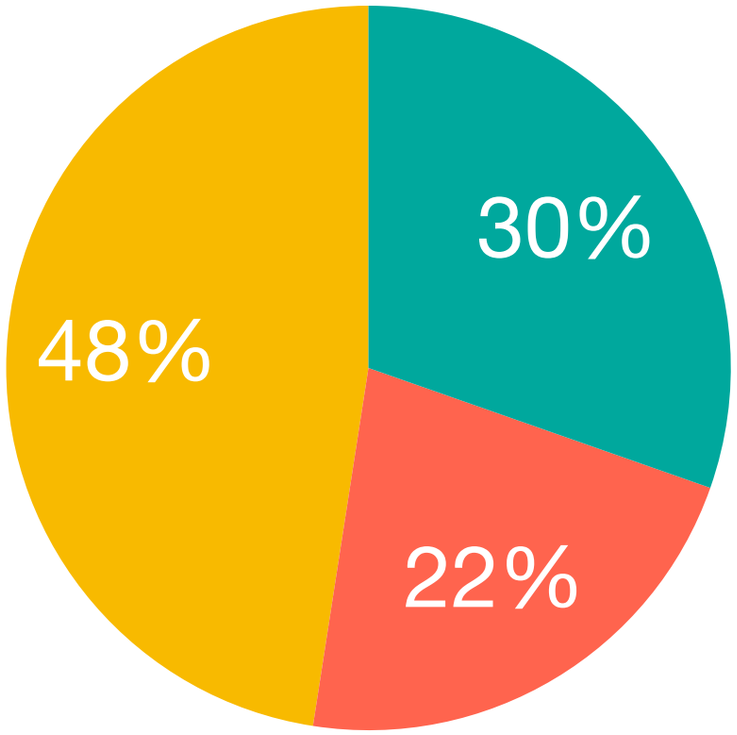
“Math is about using the right formula.”

Agree Disagree Neutral / Not Sure

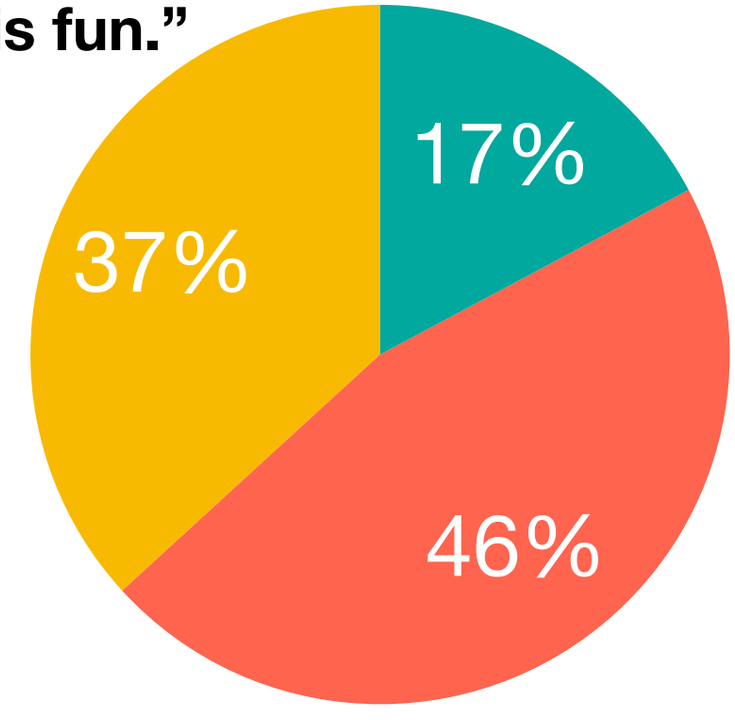
“I think I am good at math.”



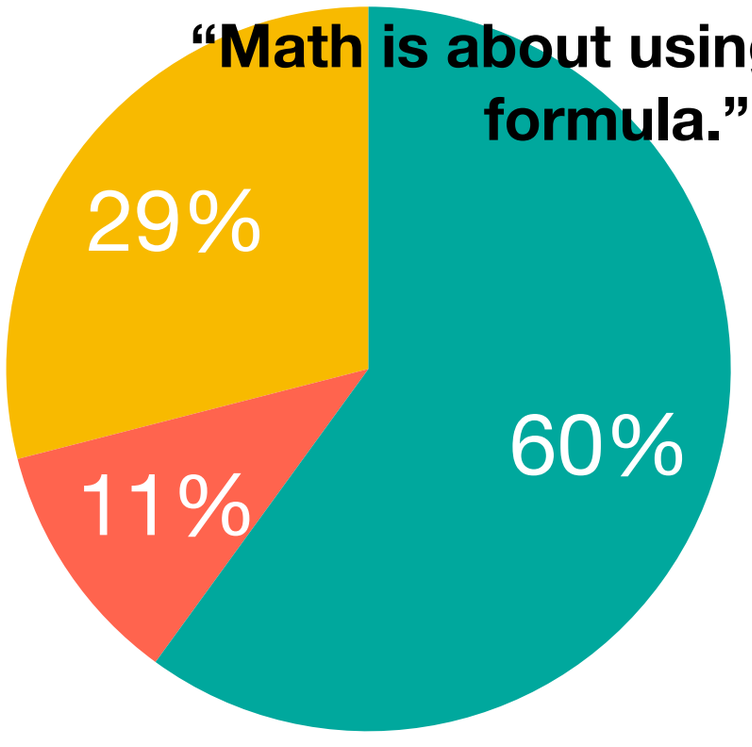
“My peers think I am good at math.”



“Math is fun.”



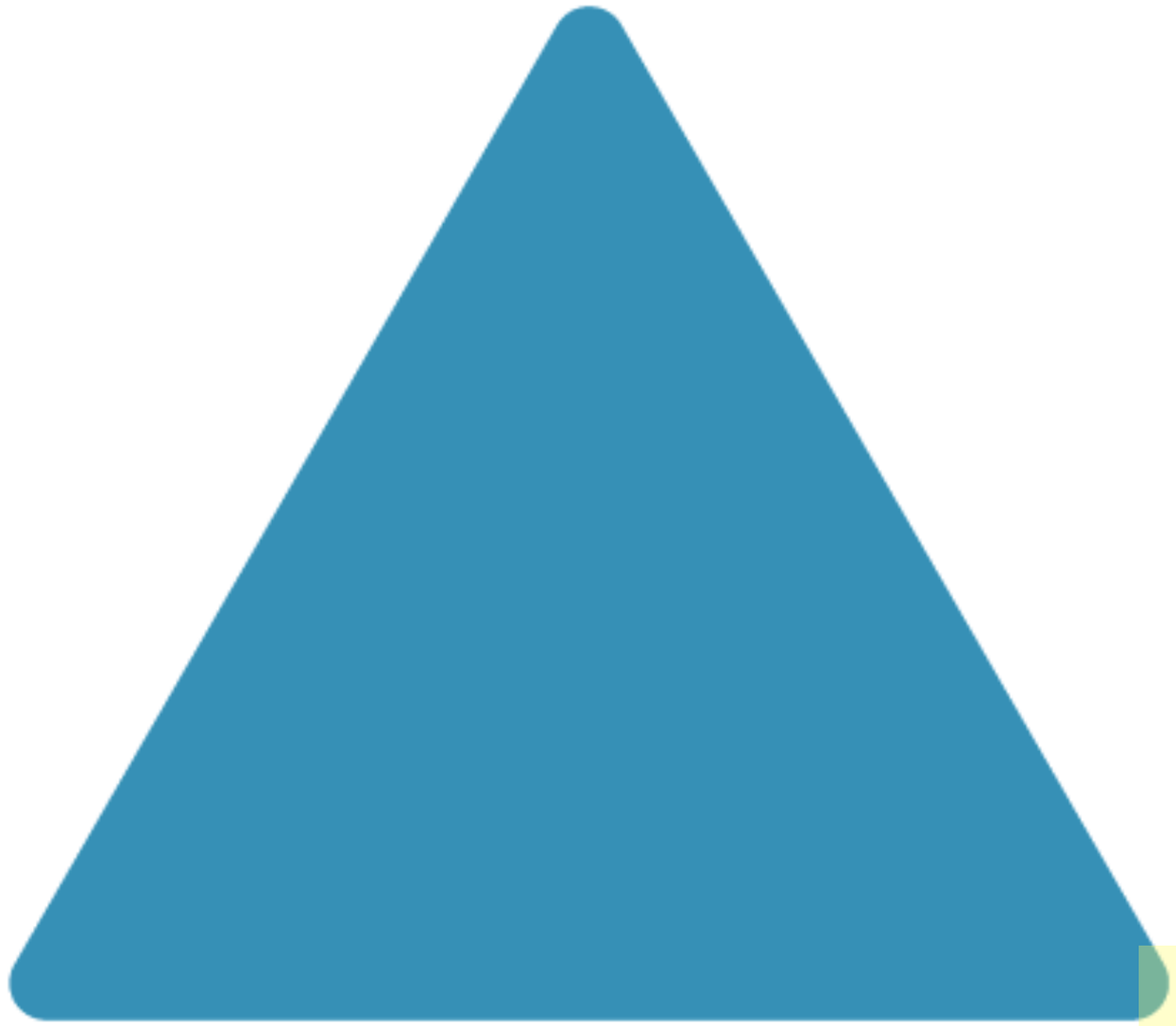
“Math is about using the right formula.”



Passive Caring vs. Active Caring

Passive Caring	Active Caring
Teacher greets students at the door.	Teacher inquires about students' well-being at the door.
Teacher has positive relationships with good students.	Teacher has positive relationships with each student.
Teacher knows each student's name.	Teacher knows each student's passions.
Teacher knows which social groups students hang out with.	Teacher knows which social groups students struggle with.
Teacher invites all students to participate.	Teacher encourages each student to participate.
Teacher allows retakes on exams.	Teacher allows retakes and reaches out to specific students and encourages them to retake an exam.
Teacher offers general praise.	Teacher offers authentic praise specific to each student.
Teacher cares about how the student is doing in math.	Teacher cares about how the student is doing in all subjects.
Teacher asks how a student is doing generally.	Teacher asks how something specific, such as work, is going.

Academic Safety



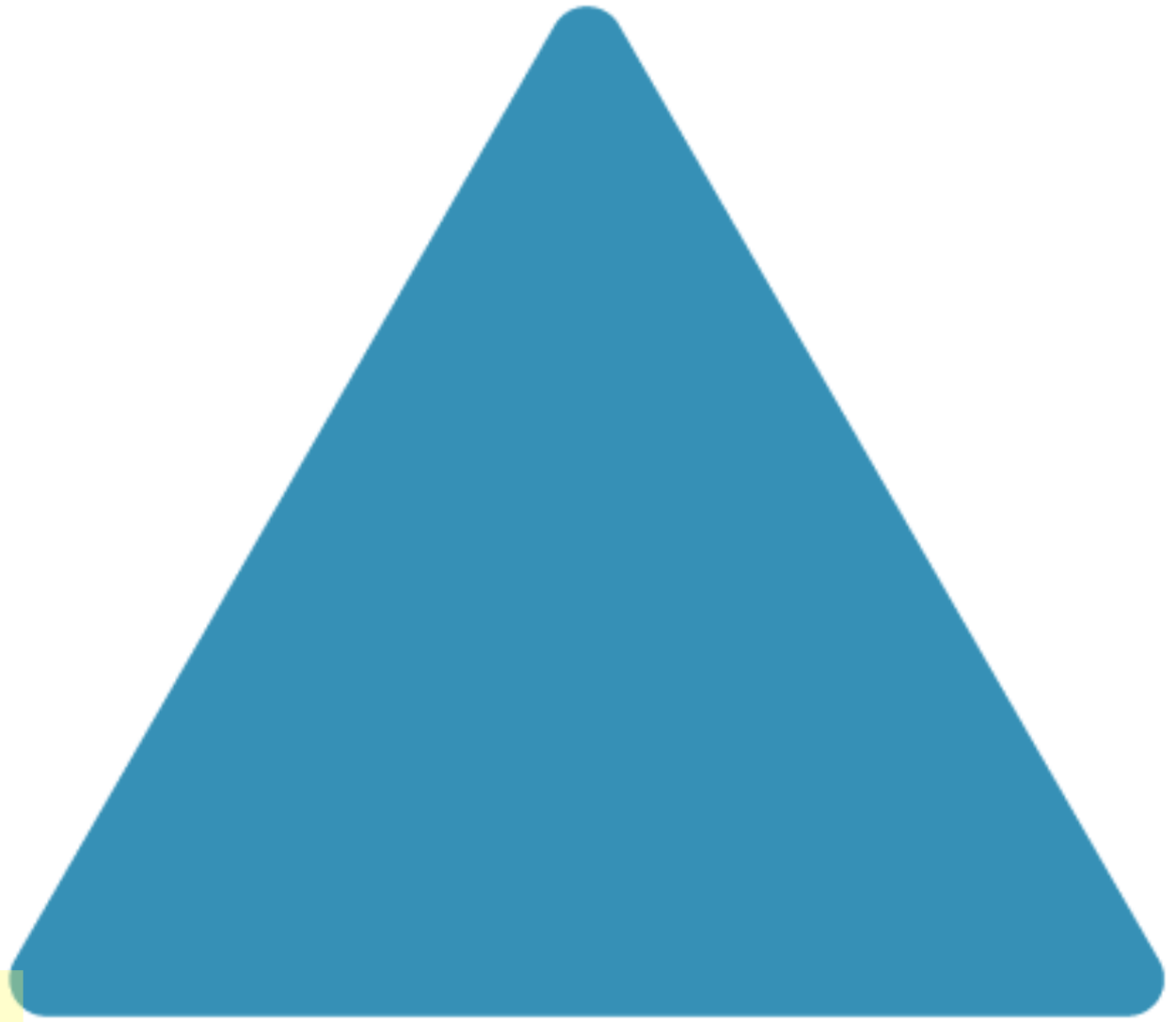
Effective Facilitation

Quality Tasks

Task Sort

As a group, order the tasks from lowest quality to highest quality, according to your sensibilities.

Academic Safety

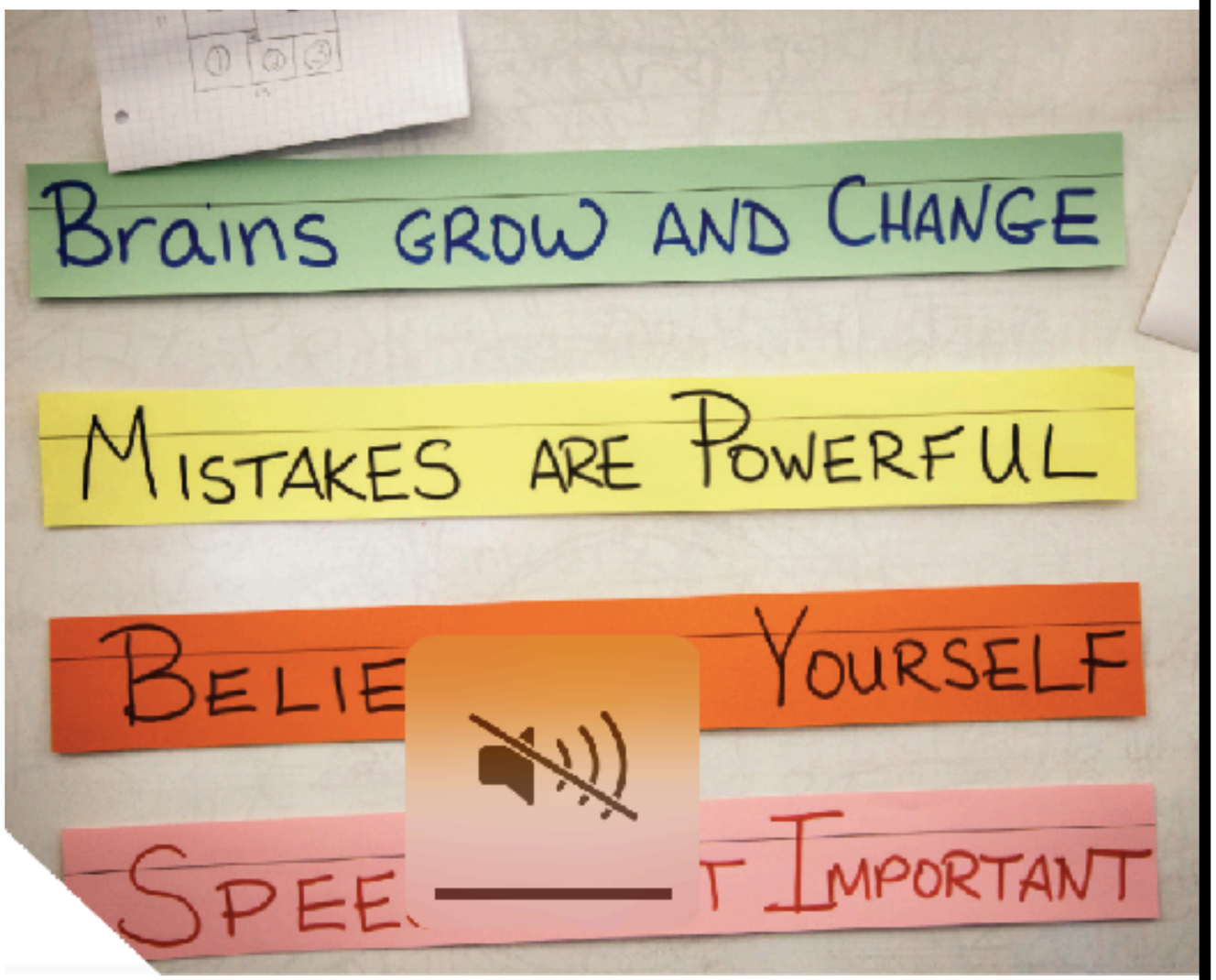


Effective Facilitation

Quality Tasks

Norms exist in your classroom, whether or not they are established

Explicit (or "hoped for") norms



Implied (or "understood") norms

The teacher will eventually give us the formula.

I get penalized socially when I answer a question incorrectly.

The teacher won't give me the benefit of the doubt.

Smart kids get extra-credit.

Hard work might pay off, getting the answers right definitely will.

It's easy to get lost and left behind if we don't catch it the first time.

NORM:
“Listen actively and respect the ideas of others.”

WELL-ALIGNED TALK MOVES:

“Can you say more about that?”

“That’s a brilliant idea. Would you mind sharing it with the whole class?”

“What do you like about her strategy?”

Norms, Structures, and Routines

In-the-moment moves

STATED NORM:

“Have a growth mindset.”

Norms, Structures, and Routines

In-the-moment moves

POORLY ALIGNED TALK MOVES:

“No retakes.”

“We already covered this.”

“We’ve already moved on to the next thing.”

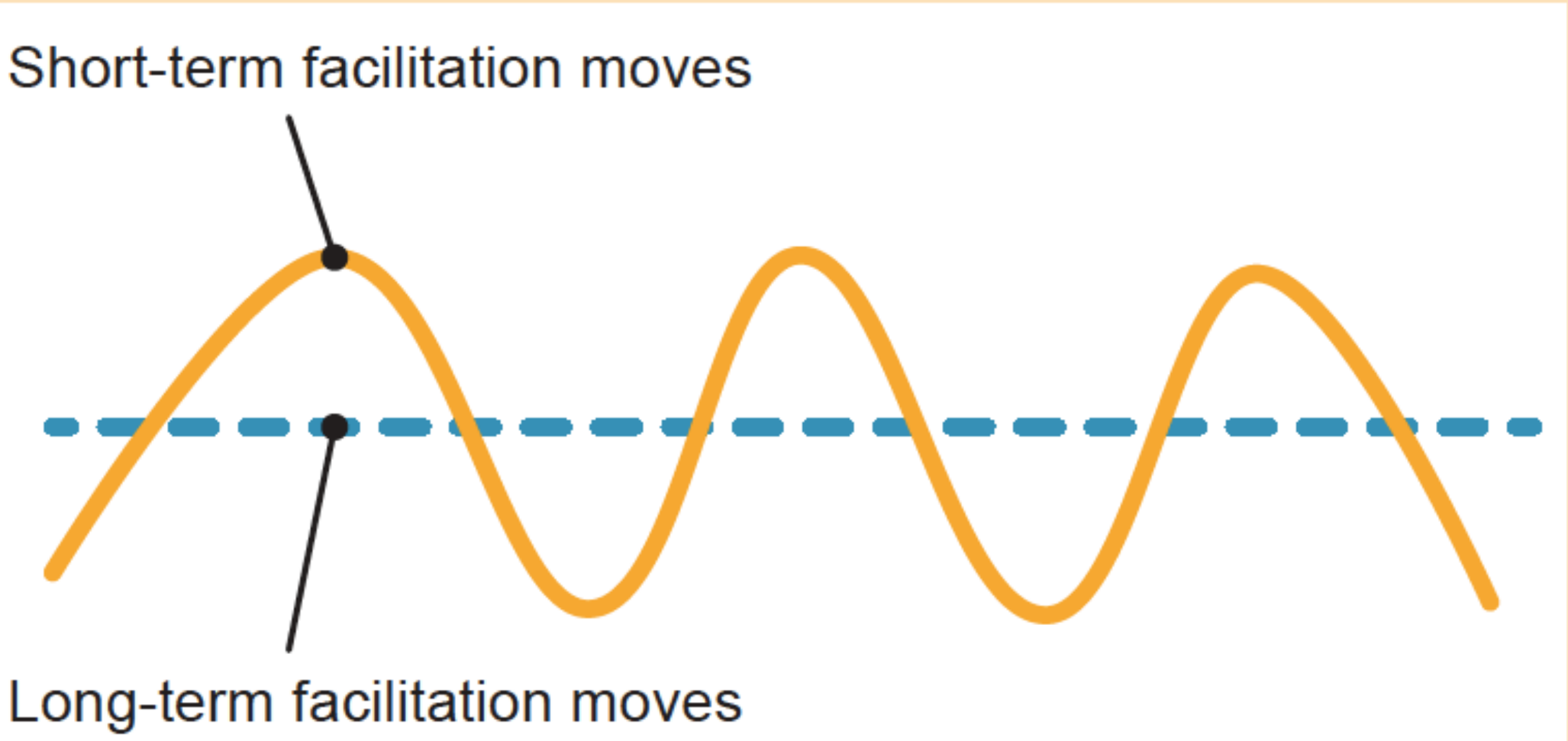


FIGURE C.1 Short-form facilitation moves are anchored to the long-term facilitation of the class, and both are important to the day-to-day well-being of the class.

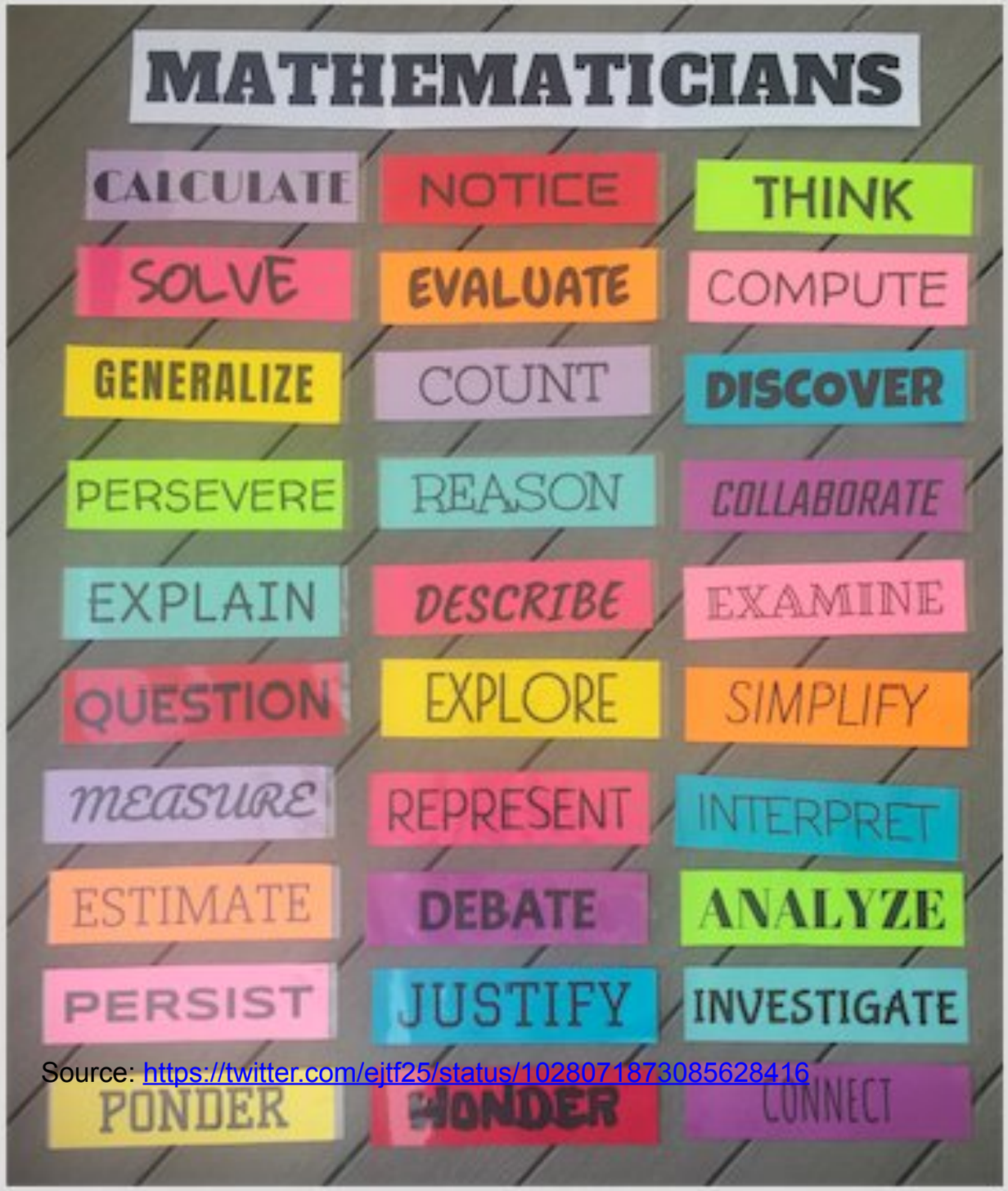
Begin problem simulation

“A Day Out”

Modified from Shell Centre

http://map.mathshell.org/

Multiple Ability Orientation



Source: https://twitter.com/ejtf25/status/1028071873085628416

Select at least one 'smartness' and make a note on your **Problem Solving Framework**.

None of us has all these abilities, but each of us has some of these abilities.

Problem Entry Event: “A Day Out”

Good morning class,

I’m so excited about our upcoming field trip! You’ll recall we have three options for our field trip: Growlets Zoo, the Prison Museum, and the Space Science Show. Yesterday I had you list your first and second choice. The results are here:

Name	First Choice	Second choice
Olivia	Zoo	Space show
Grace	Space show	Prison museum
Jessica	Prison museum	Zoo
Ruby	Zoo	Space show
Emily	Space show	Prison museum
Sophie	Prison museum	Zoo
Chloe	Prison museum	Space show
Lucy	Prison museum	Space show
Lily	Space show	Prison museum
Ellie	Space show	Prison museum
Ella	Zoo	Space show
Charlotte	Space show	Prison museum
Katie	Space show	Prison museum
Mia	Zoo	Space show
Hannah	Zoo	Space show

Name	First Choice	Second choice
Jack	Prison museum	Zoo
Thomas	Zoo	Prison museum
Joshua	Zoo	Prison museum
Oliver	Space show	Prison museum
Harry	Prison museum	Zoo
James	Zoo	Space show
William	Space show	Space show
Samuel	Zoo	Prison museum
Daniel	Zoo	Space show
Charlie	Prison museum	Prison museum
Benjamin	Space show	Zoo
Joseph	Zoo	Prison museum
Callum	Zoo	Prison museum
George	Prison museum	Space show
Jake	Space show	Prison museum

I would like you to analyze the results from the survey and come to a consensus as a group on which field trip to take. Be sure to employ as *fair reasoning* as possible, while

Mr Richards, a teacher from Bosworth School, plans to take 30 students on a school trip. Here are the places they could visit.

Growlets Zoo	Prison Museum	Space Science Show
		
36 miles from Bosworth Entrance fee $2.50 per person	30 miles from Bosworth Entrance fee $6 per person	10 miles from Bosworth Entrance fee $10 per person

Norm monitoring

Group Lovelace

+

+

Δ

Δ

Group Turing

+

+

Δ

Δ

Group Mirzakhani

+

+

Δ

Δ

Group Malone-Myers

+

+

Δ

Δ

Group Noether

+

+

Δ

Δ

Group Erdos

+

+

Δ

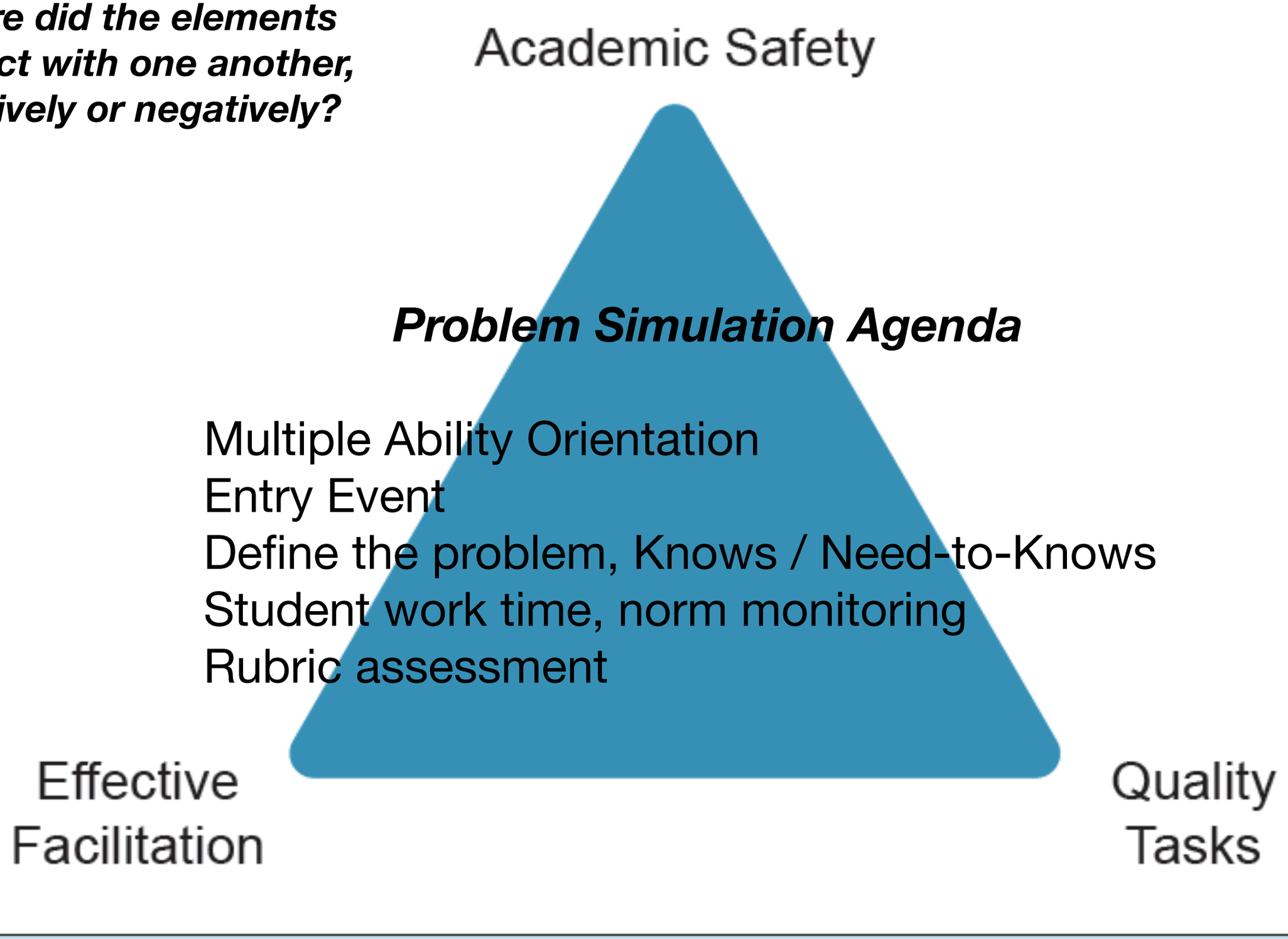
Δ

Rubric: Self-Assess

	EMERGING	DEVELOPING	PROFICIENT	ADVANCED
Actively Participate	Stays focused for part of the activity/discussion, team meeting, or independent time but often cannot resist distraction or does not notice when or why a loss of focus happens.	Mostly stays focused on the activity/discussion, team meeting, or independent time, and knows when and why disengagement or distraction happens.	Actively participates in the activity/discussion, team meeting, or independent time and has strategies for staying focused and resisting most distraction.	Actively participates and takes initiative on the activity/ discussion, team meeting, or independent time and has strategies for staying focused.
Seek Feedback	Rejects feedback and/or does not revise work.	Sometimes shows evidence of accepting feedback to revise work, but at times may resist when it's difficult.	Consistently shows evidence of accepting and using feedback to revise work to high quality.	Consistently shows evidence of actively seeking, identifying, and using feedback to revise work to high quality.

Where did you see elements show up?

Where did the elements interact with one another, positively or negatively?



Takeaway Resources

Task-Quality Checklist

Hallmarks of a Quality Task	Quality Assessment
Quality tasks do the following: • Spark curiosity and foster engagement • Yield creativity and lead to new ideas • Promote access for all students in the classroom • Require and convey deep, crucial mathematical content • Connect and extend content	Here are a few potential indicators for each hallmark of a quality task. Although it isn't necessary for a task to contain all hallmarks or all indicators, consider modifying them to maximize the number of each. **Spark curiosity and foster engagement** ☐ Task stirs curiosity in the teacher. ☐ Task elicits student questions and questioning. ☐ Task contains just-out-of-reach information. ☐ Task elicits a student prediction. ☐ Task breaks expectations in some way. **Yield creativity and lead to new ideas** ☐ Task invites new definitions from students. ☐ Task has multiple solution paths. ☐ Task has multiple solutions. **Promote access for all students** ☐ Task is clear and to the point. ☐ Task includes or necessitates a diagram. ☐ Task ensures all students can get started. ☐ Task includes multimedia. **Require and convey deep, crucial mathematical content** ☐ Task is aligned to important standards. ☐ Task results in long-term conceptual understanding. ☐ Prompt contains qualifying words such as most, least, highest, lowest, closest, etc. ☐ Task involves a comparison. **Connect and Extend Content** ☐ Task uses know-how from previous lessons. ☐ Task hints at future lessons. ☐ Task contains concepts from other content areas (math or otherwise).

Math Mindsets and Attitudes Student Survey

Section 1

Free association: When you hear the word *math*, what words pop into your head? (2 minutes)

Section 2

Freewrite: What kinds of things do you do in your math classes? (2 minutes)

Section 3

Freewrite: What would you like to do more of in math class? What would you like to do less of in math class? (2 minutes each; 4 minutes total)

More of:

Less of:

Section 4

Prompt: Do you think you are smart in math? Why or why not? (2 minutes)

Necessary Conditions

Essential Elements for Secondary Math Learning

Geoff Krall | gmkrall@gmail.com | @geoffkrall
New Tech Network