The background is a dark grey collage of white chalk-like drawings. It includes a globe in the upper left, a microscope on the left side, a stack of books at the bottom left, a satellite or space station in the lower middle, and various mathematical symbols like a percent sign, an exclamation point, and a less-than sign on the right. The overall theme is science and mathematics.

The Vocabulary of Math and Science: Harnessing the Power of Language

Anne Karabon, PhD
University of Nebraska at Omaha

Outcomes

- Examine the social and cognitive potential of using science and math talks with young children.
- Discuss the role of the teacher for vocabulary development
- Learn innovative ways to support children's use of vocabulary words as "tools" to communicate (listening, speaking, reading, and writing).
(Nagy & Townsend, 2012).

In what ways are you currently using math and science vocabulary you use everyday in your classroom?

What do we know?

There is a lot DOING math and science, however there is not as much TALK in science and math.

“Jamal is making sandwiches. He makes 6 sandwiches.” Student obediently draw six sandwiches on their white boards. “Then Jamal eats two of the sandwiches.” Students begin crossing out two of the sandwiches. “How many sandwiches are left?” Some students quickly shout out, “Four!” causing others to look around at their neighbors’ whiteboards and quickly write a 4 also.

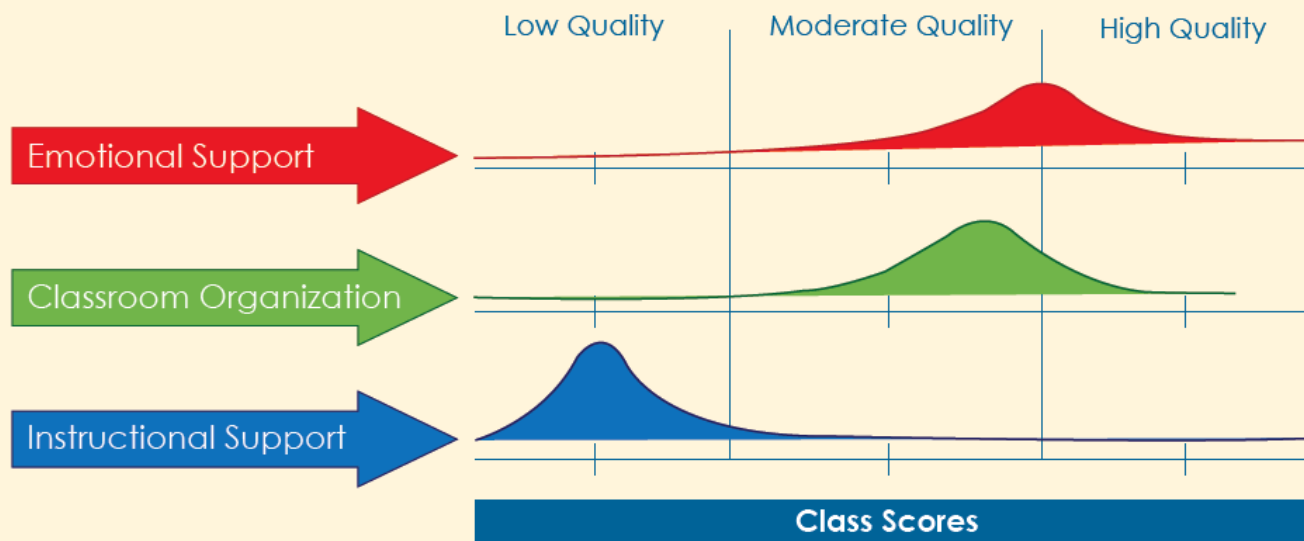
Lomax, K., Alfonzo, K., Dietz, S., Kleyman, E., & Kazemi, E. (2017). Trying three-acts tasks with primary students. *Teaching Children Mathematics*, 24(2), 113-119.



What do we know?

This figure illustrates that across several thousand Pre-K-3rd classrooms observed throughout the country, children tend to experience moderate to high levels of effective interactions for emotional support and classroom organization. However, most children attend Pre-K-3rd classrooms characterized by very low levels of instructional support.

Average Ratings of Interactions in Pre-K - 3rd Classrooms



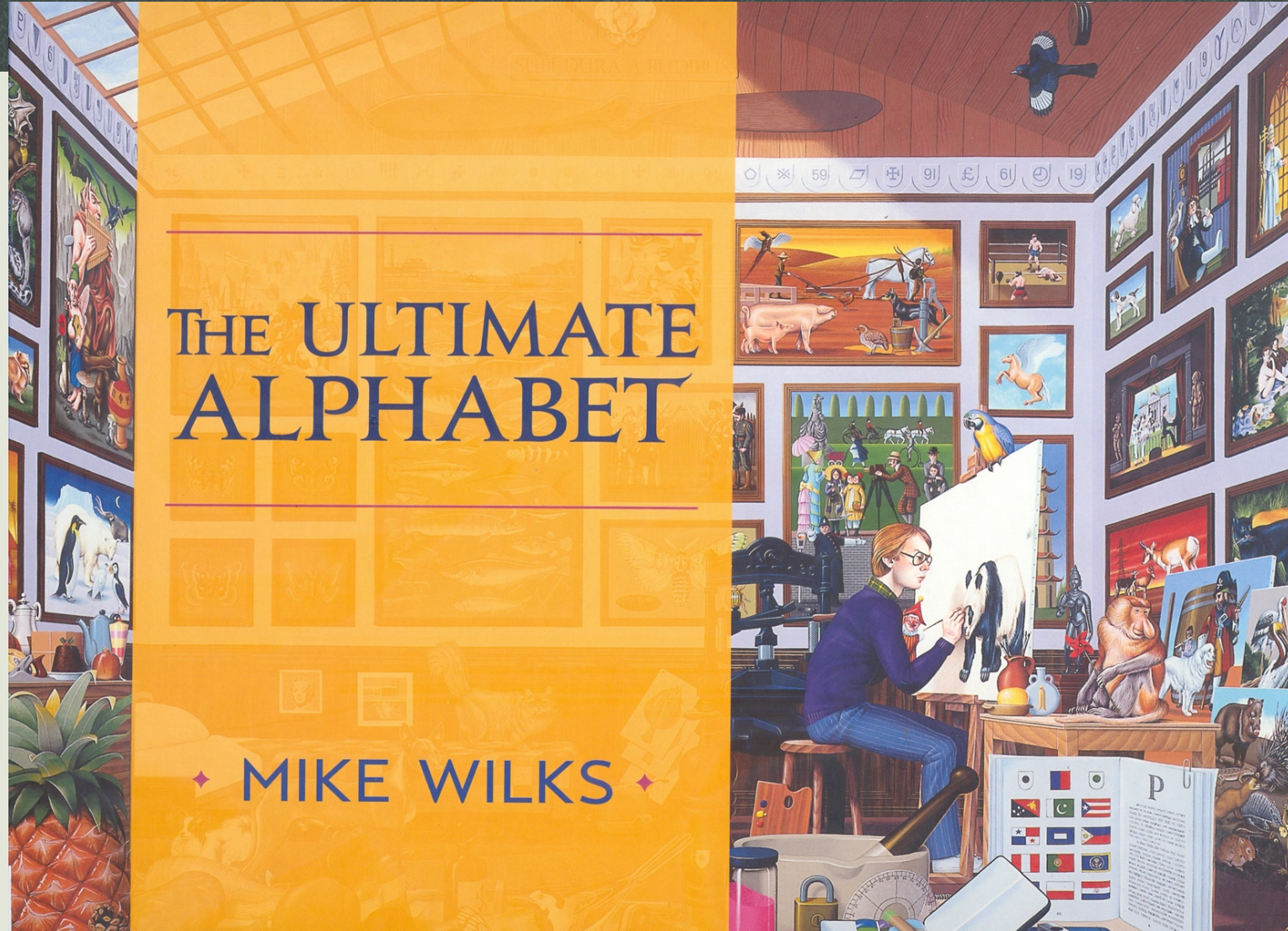
GOAL:

To create a discourse-rich classroom culture where the natural synergy between language and meaning making supports ALL students in expressing ideas, developing language and acquiring new knowledge of scientific phenomena and mathematical concepts.



We can't teach what we don't know

ACTIVITY



The Language of Math

- Early mathematics is a predictor of future academic achievement (Duncan, et al., 2007)
- Competency with mathematics requires use of numerals and symbols as well as understanding and use of mathematics vocabulary (Powell & Nelson, 2017).
 - Academic vocabulary: sum, octagon, product
 - Everyday language: more, quarter
- Word problems are obvious however language and linguistic use is present in all aspects of mathematics.
 - Practice and in directions (use a ruler to measure to the nearest cm)
- Exposure + Production = Acquisition
 - Oral and written (Ernst-Salvit & Mason, 2011) as well as gestures and images- (Simpson & Cole, 2015)

Math Talks

A lot of math learning occurs in the context of classroom play, especially when teachers are **talking with children** about how to **solve problems** involving numbers. Teachers **model** the language by providing **content-rich words** for what they notice children doing.

NCTM (2006) students are to “use language” (p.11) and “develop vocabulary to describe” (p.31) and express mathematical ideas.

Math Talks

<https://www.teachingchannel.org/video/pre-k-spatial-relations-dreme>

SPATIAL AWARENESS
ACTIVITY

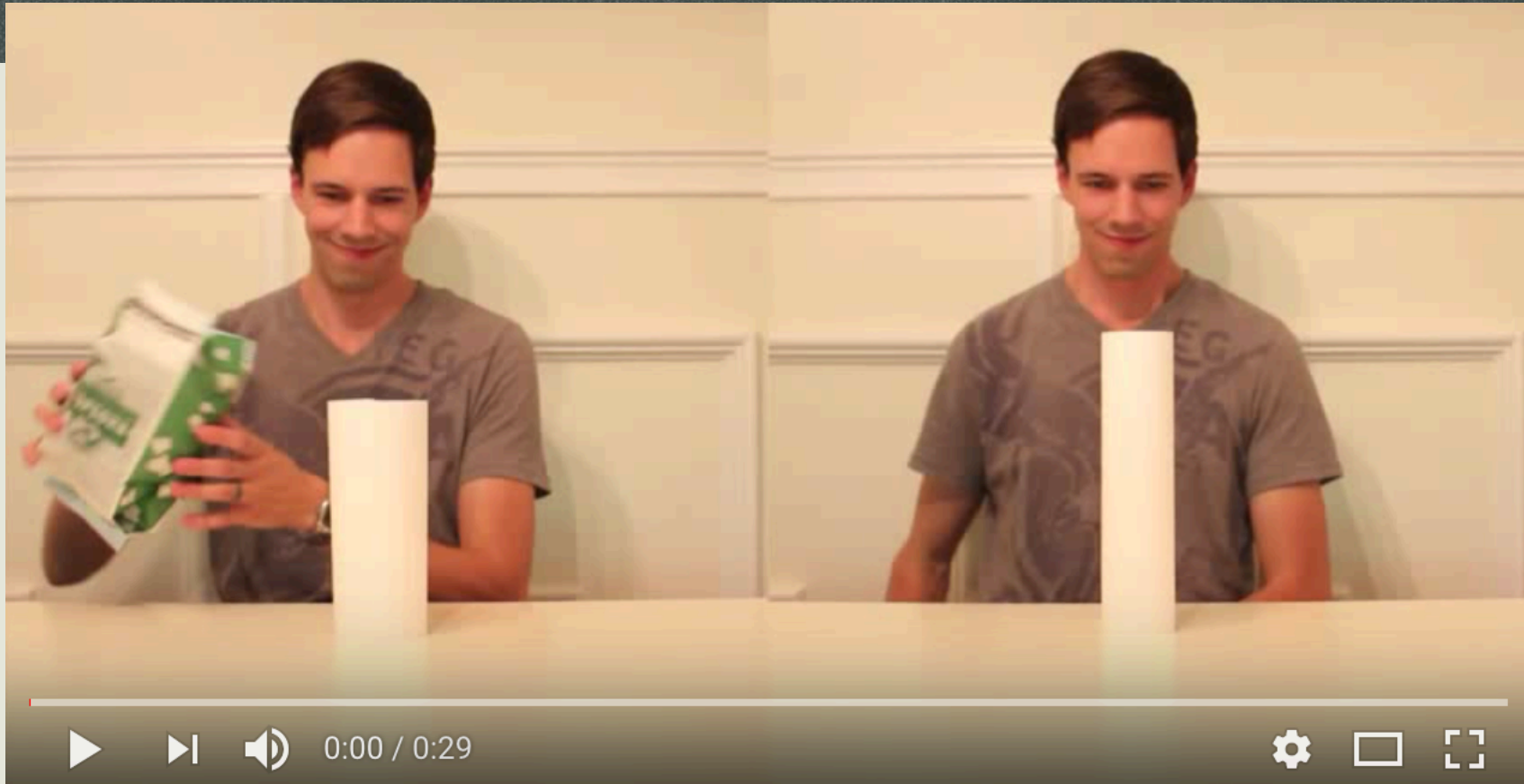
LINE ACTIVITY: 1st-3rd Grade



Spatial Awareness for 1st-3rd grade

- Make a line segment (part of a line that has two endpoints) on your graph paper.
- Can be straight or curved but can not overlap itself. Can be horizontal, vertical or angled.
- On the separate paper, describe your line.
- Fold the graph paper in half, then half again. Put it somewhere (pocket, bag, on the floor) out of sight.
- Draw a card. Find your matching partner ONLY using your words. NOT showing your card.
- Give them your directions. Using the other side of the graph paper, follow their directions to draw their line segment.
- Show your drawing to them.
- Compare what your partner drew to what you described.

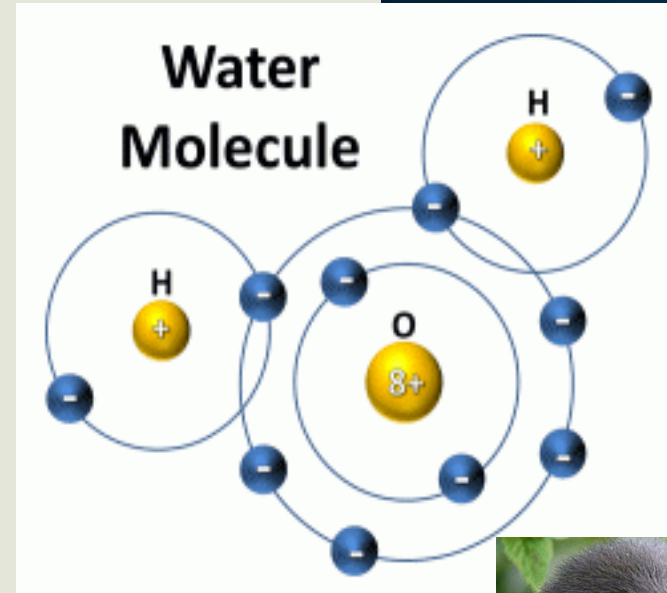
Lomax, Alfonso, Dietz, Kleyman, & Kazemi (2017)



- <https://www.youtube.com/watch?v=GCBNNhG-TN8>
- <https://gfletchy.com/3-act-lessons/> (The Candyman and The Juggler) <http://www.101qs.com/>

The Language of Science

- Research-based strategies for supporting vocabulary development with young children
 - Present words in meaningful contexts
 - Verbal explanation of new vocabulary through explicit and implicit instruction (Neuman & Wright, 2014)
 - Teacher and students create a visual representation
 - Teacher and students act out new vocabulary
 - Students have multiple opportunities to use new words in meaningful ways.



Science Talks

When students have conversations in which they share their **observations**, interpret evidence, and explain their **findings**, they support one another in making **connections**, refining ideas, and developing new perspectives.



Let's Talk Science PART 1

- **What do you think this means? Why do you think that?**
- **Here's another way to think about that...**
- **Why do you think that would count as evidence?**
- **What else could we measure or describe to make a claim?**
- **I don't understand why you think that. Will you tell me your reasoning?**
- **How can we use that to make a case for our idea?**
- **How will we explain this?**
- **Good idea, but what about this?**
- **What other evidence could go with that?**
- **• Sounds good, tell me more.**

Adpoted from Leana Peltier's presentation at NSTA conference 2017

Let's Talk Science PART 2

- **Why do you think that? What is your reasoning?**
- **What is the evidence for that?**
- **Why do you think that counts as evidence?**
- **What claim can we make about it?**
- **Do you agree? Do you disagree? Why?**
 - **I agree because...**
 - **I don't agree because...**

What kind of evidence do we need?

- **How can we explain this one over here?**
- **We don't have to keep that claim. We could change our claim..**
- **This makes sense to me...**



In what ways are you currently using math and science vocabulary you use everyday in your classroom?

What will you focus on or incorporate into your practice tomorrow (next week)?

Questions, Comments
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