# Reflections

**If you do not speak & read Spanish…**

- How did you access the task?
- What resources did you use to engage?
- How did it feel to depend on colleagues?

**If you do speak & read Spanish…**

- How did you make sense of the task?
- What visual representations did you make?
- How did it feel to have colleagues depend on you?

# A Critical Question

How can we teach rigorous mathematics to all students, including emergent bilingual students who are learning English as an additional language?

# Language(s) & Learning Mathematics

**Isn’t 1+1 the same in any language?**

# Language(s) & Learning Mathematics

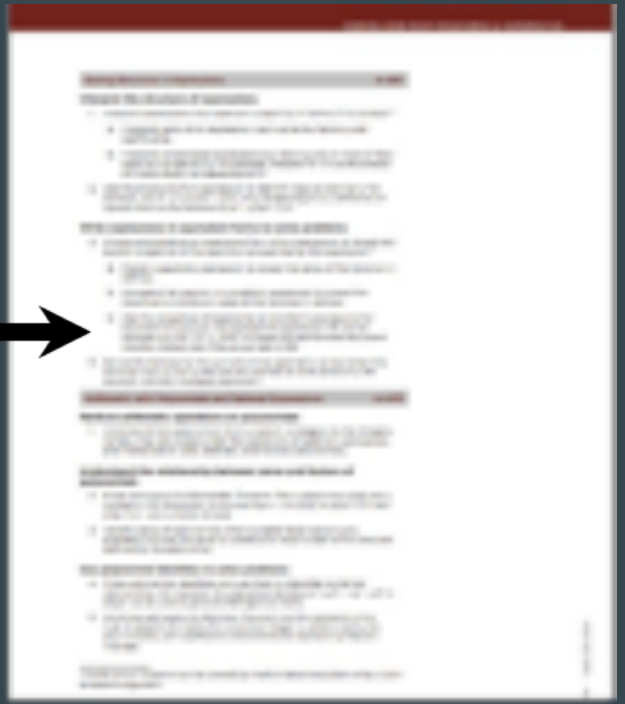
## Common Core State Standards

### Standards for Mathematical Practices

**Mathematical Practices**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

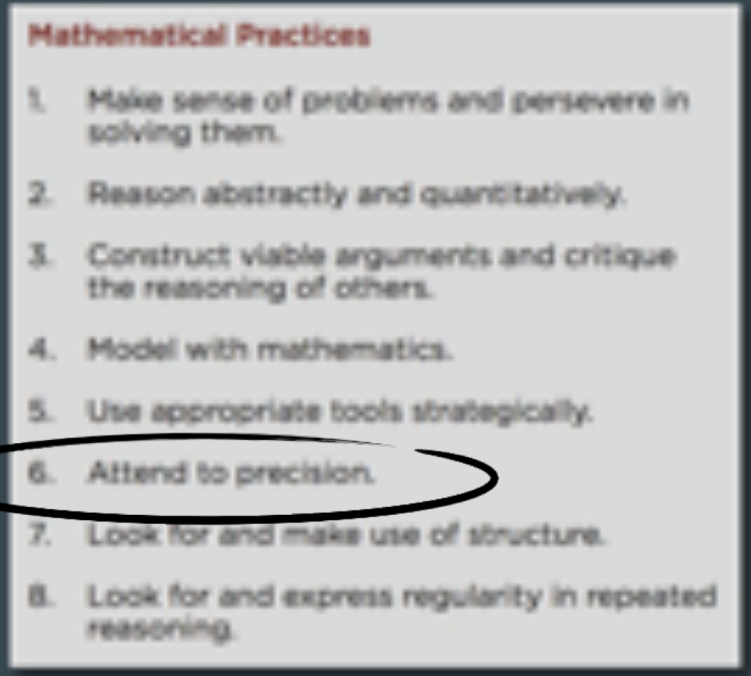
### Standards for Mathematical Content



# Language(s) & Learning Mathematics

## Common Core State Standards

### Standards for Mathematical Practices



**Mathematical Practices**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

**"Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning.... In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions."**

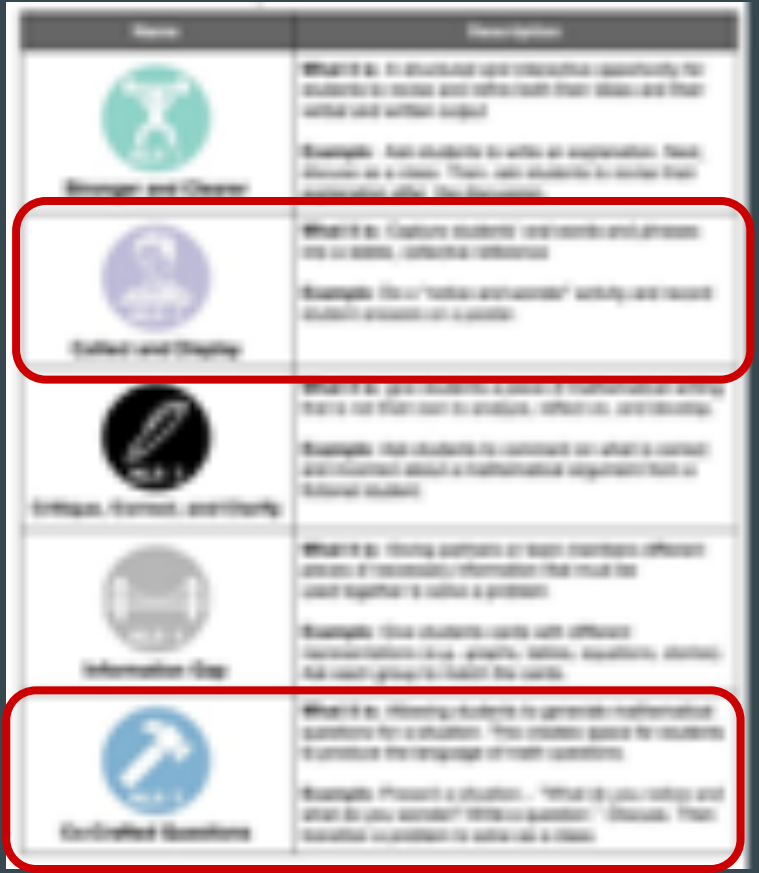
# Current Research

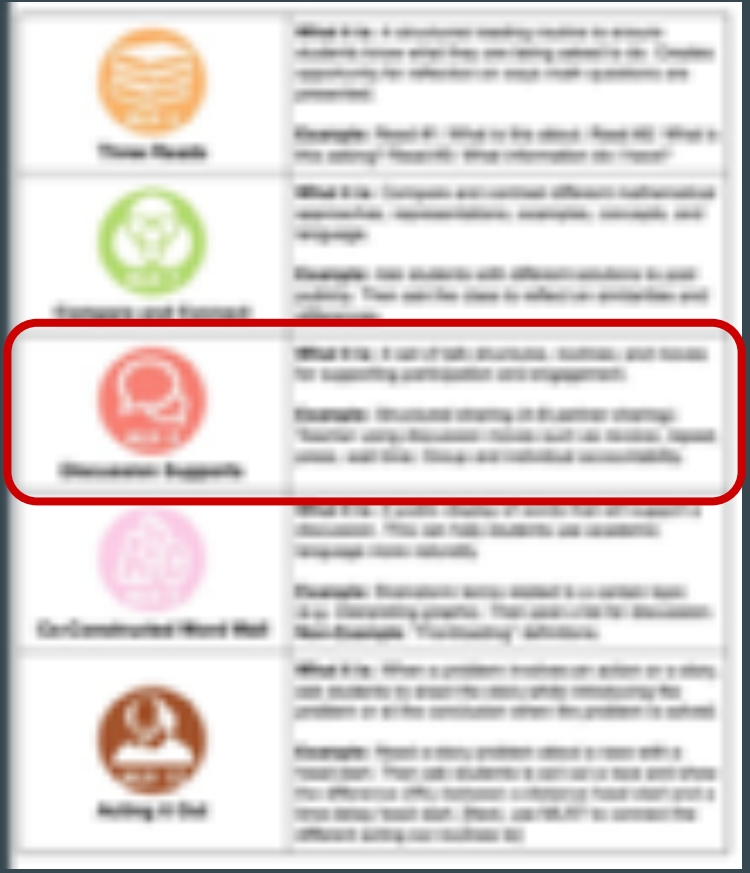
NSF CAREER Grant supporting 5 Year design and development study in 9th grade mathematics course in local high school

Our goal is to promote student participation and discussions. Today, we're going to highlight how we use language structures to promote equitable student engagement → Mathematical Language Routines (MLRs)

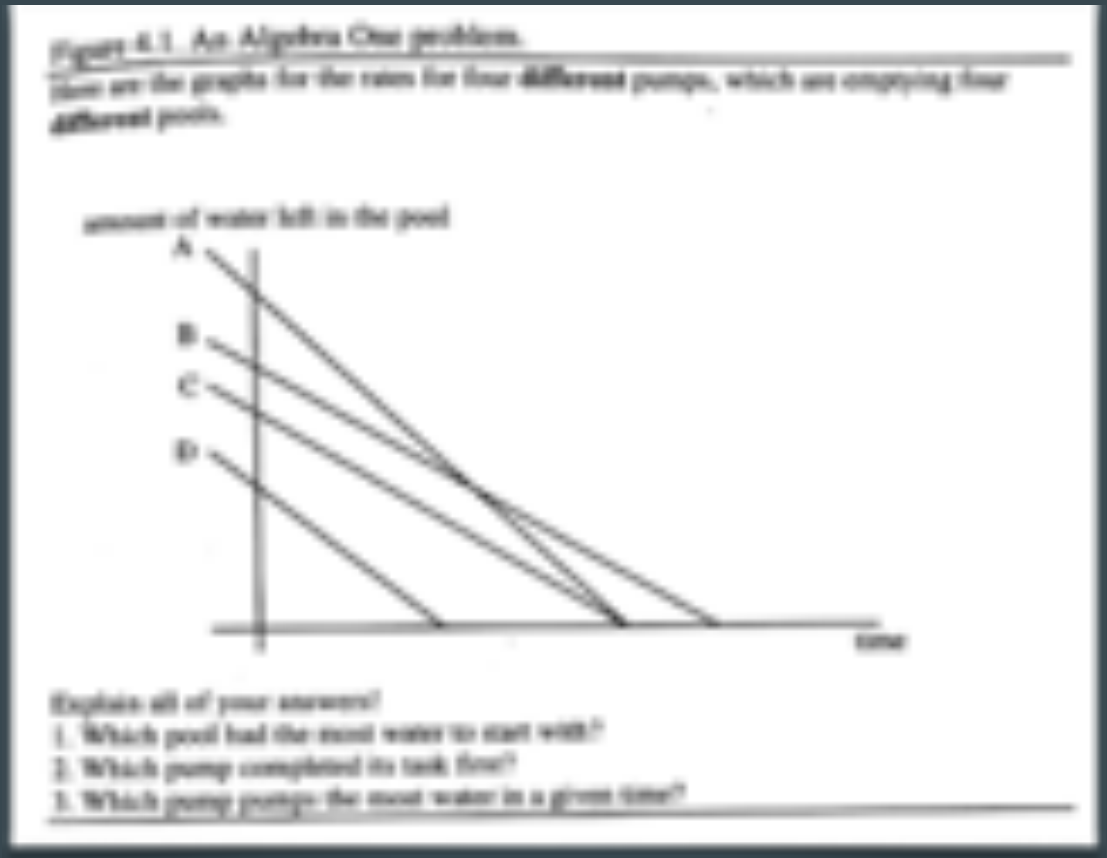
# Mathematical Language Routines (MLRs)

# Mathematical Language Routines (MLRs)





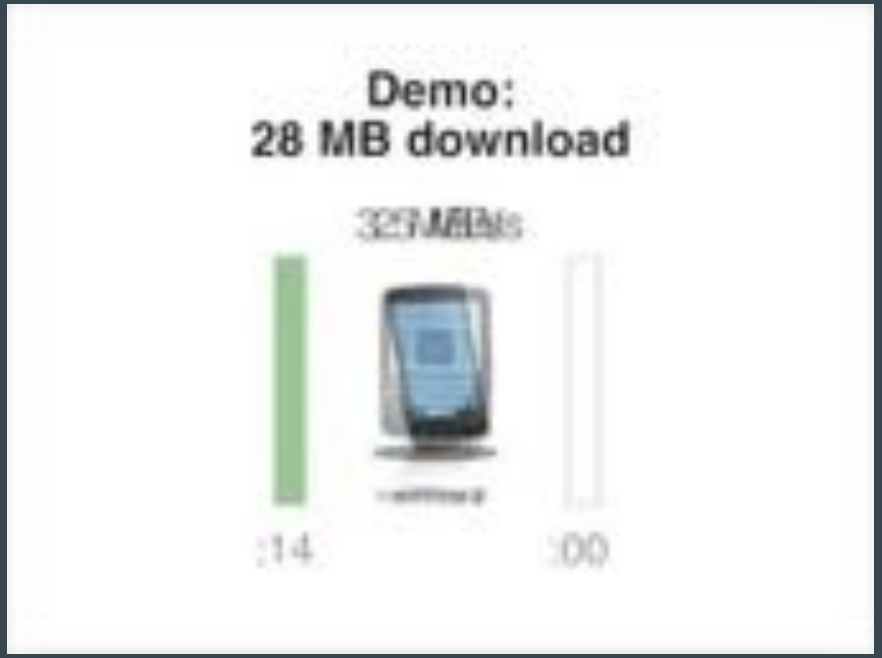
# Example




Chazan, D. (2000) *Beyond Formulas in Mathematics and Teaching*. New York: Teachers College Press

# Download Rates

**What do you notice? What do you wonder?**




# Download Rates

**What do you notice? What do you wonder?**


**What do you notice?**

- 

**What do you wonder?**

- 

# Download Rates

Four friends disagree about whose phone is faster at downloading videos.

They test their phones by downloading different videos. Each friend writes down how large the video file is and how much time the phone used to download the video.

They use their information to make a graph showing the time each phone used to download a video. The phones are labeled A, B, C, and D.

# Sample Tasks

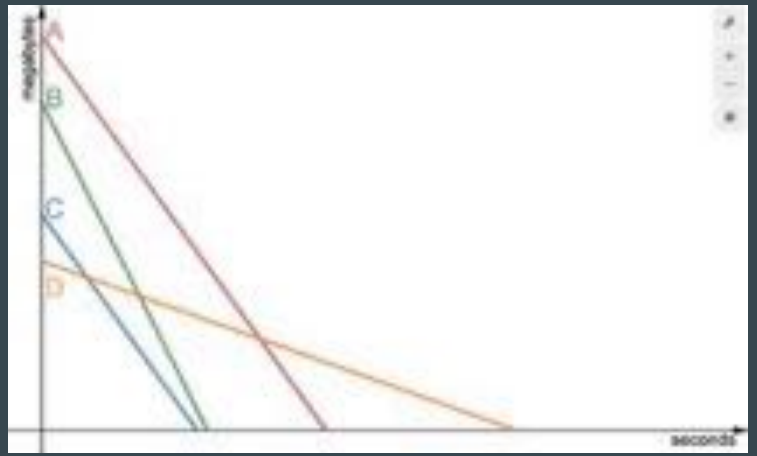
P. ###

1) Which phone downloaded the biggest video file? Where do you see this on the graph?

2) Which phone completed the download in the smallest amount of time? Where do you see this on the graph?

3) Which phone downloads fastest? How do you know?

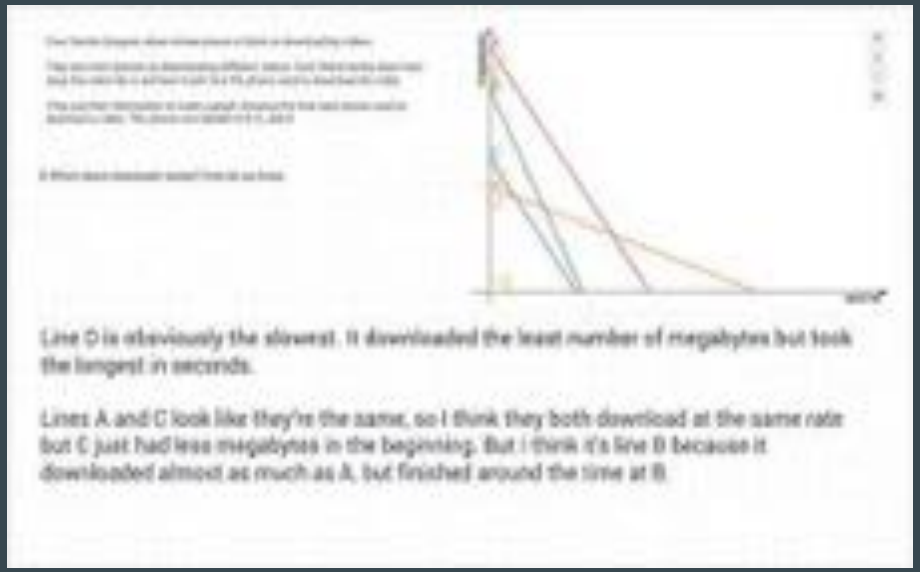
4) What else do you notice about this graph?



# Gallery Walk

P. ###

- Please view some of the sample responses on Jamboard link (see handout, p. 8)
- Then edit your solution, as needed.



Line D is obviously the slowest. It downloaded the least number of megabytes but took the longest in seconds.

Lines A and C look like they're the same, so I think they both download at the same rate but C just had less megabytes in the beginning. But I think it's line B because it downloaded almost as much as A, but finished around the time at B.

Line B was the fastest because it has the highest rate of change

# Whole Class Discussion

- Where did you see language structures in this presentation?

San Diego State University
TODOS
California Mathematics Council
Supported in part by NSF
Awards #1553708 and #0424983
NSF

# Whole Class Discussion

- Where did you see language structures in this presentation?
  - Notice and wonder (Co-Crafted Questions)
  - Modified gallery walk (Collect and Display)
  - Alternating between small group and whole class (Discussion Support)

- How can you bring this back to your school site?

**https://meld.sdsu.edu/**

San Diego State University
TODOS
California Mathematics Council
Supported in part by NSF
Awards #1553708 and #0424983
NSF

# Selected References


Celedon-Pattichis, S., & Ramirez, N. G. (2012). *Beyond good teaching : advancing mathematics education for ELLs*. Reston, VA: National Council of Teachers of Mathematics.

Chval, K. B., & Chávez, Ó. (2012). Designing Math Lessons for English Language Learners. *Mathematics Teaching in the Middle School*, *17*(5), 261–265. https://doi.org/10.5951/mathteacmiddscho.17.5.0261

Coggins, D., Kravin, D., Coates, G. D., & Carroll, M. D. (2014). *English language learners in the mathematics classroom*. Retrieved from https://www.overdrive.com/search?q=A301EEAD-14A4-49A4-9EF8-7F2E58AE21C4

Driscoll, M., Nikula, J., & DePiper, J. (2016). *Mathematical thinking and communication: access for English learners*. Portsmouth, NH: Heinemann.

Moschkovich, J. N. (1999). Supporting the participation of English language learners in mathematical discussions. *For the Learning of Mathematics*, *19*, 11–19.

Moschkovich, J., & Zahner, W. (2018). Using the academic literacy in mathematics framework to uncover multiple aspects of activity during peer mathematical discussions. *ZDM*. https://doi.org/10.1007/s11858-018-0982-9

Moschkovich, J. (2015). Academic literacy in mathematics for English Learners. *The Journal of Mathematical Behavior*, *40*, 43–62. https://doi.org/10.1016/j.jmathb.2015.01.005

Walqui, A. (2006). Scaffolding Instruction for English Language Learners: A Conceptual Framework. *International Journal of Bilingual Education and Bilingualism*, *9*(2), 159–180. https://doi.org/10.1080/13670050608668639

Zahner, W. (2012). ELLs and group work: It can be done well. *Mathematics Teaching in the Middle School*, *18*, 156–164.

Zahner, W., Velazquez, G., Moschkovich, J. N., Vahey, P., & Lara-Meloy, T. (2012). Mathematics teaching practices with technology that support conceptual understanding for Latino/a students. *Journal of Mathematical Behavior*, *31*, 431–446. https://doi.org/10.1016/j.jmathb.2012.06.002

Zahner, William, Milbourne, H., & Wynn, L. (2018). Developing and refining a framework for mathematical and linguistic complexity in tasks related to rates of change. *The Journal of Mathematical Behavior*. https://doi.org/10.1016/j.jmathb.2018.04.003



San Diego State University

TODOS

California Mathematics Council

Supported in part by NSF
Awards #1553708 and #0424983

NSF