CADRE Learning Series: Using Video in DRK-12 Research

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Joanne Lobato
San Diego State University

Overview of our NSF Project

Developing and Investigating Unscripted Dialogic Mathematics Videos

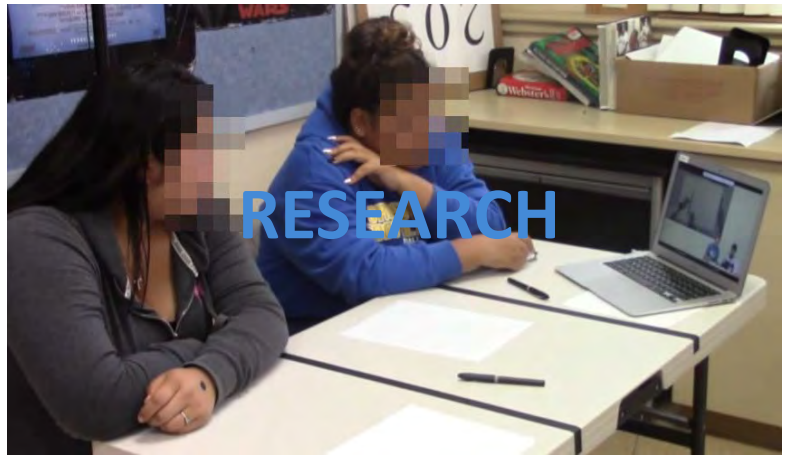
Co-PI: John Gruver, Michigan Technological University

MathTalk

Purpose

- Create an alternative type of math video that features pairs of secondary school students engaged in dialogue as they work together to tackle challenging math problems

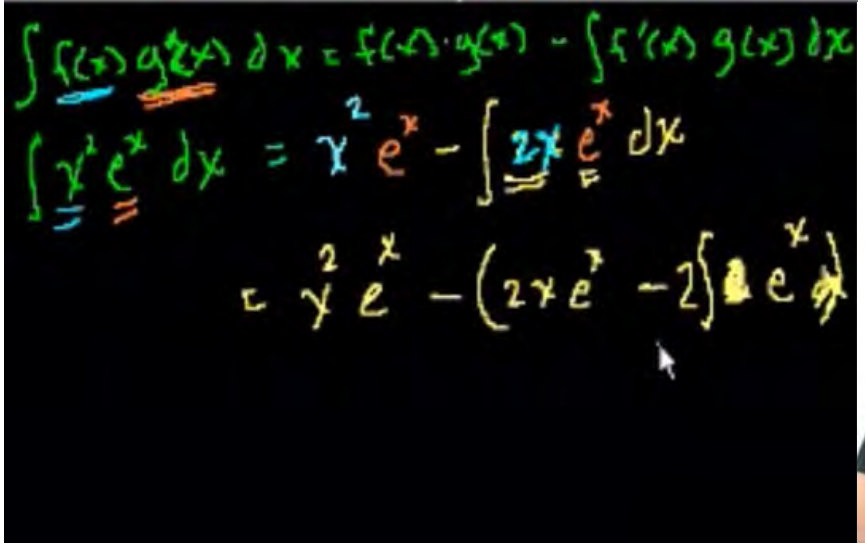
- Conduct a series of research studies that investigate what and how other students learn from the videos

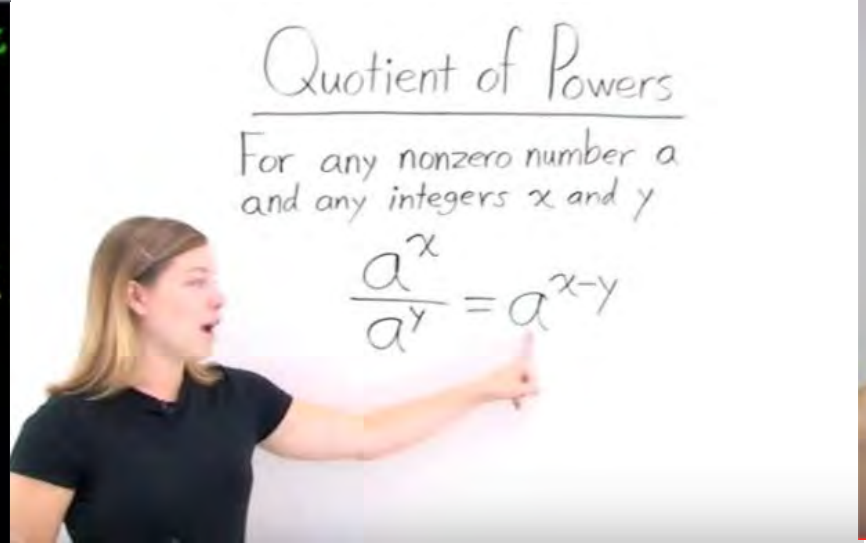


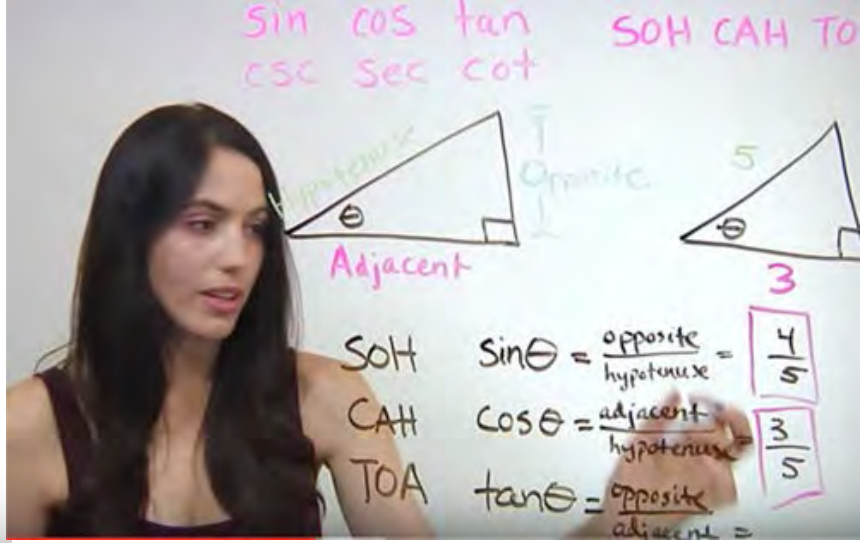
Motivation for Project MathTalk

The COVID-19 pandemic demonstrated the tremendous need for high-quality online instructional videos


tecmath
MathVids
XOLVR
community driven learning
Yay Math!
LearnZillion
brightstorm
STUDY YOUR WAY
MATHODMAN
That Tutor Guy
MATH MATTERS EVERYWHERE
YOUTUBE.COM/MATHMATTERSEVERYWHERE
KHAN
MooMooMath
Quick Math Homework Help
mashup math







"…. videos mostly **present procedures,** factual information and worked examples, without explaining why procedures work, unpacking mathematical relationships, or developing mathematical meanings" (Klinger & Walter, 2022)

Voices of students are largely missing in math videos for K-12 students learning

Students rap formulas

Lobato, Walters, & Walker (2016)

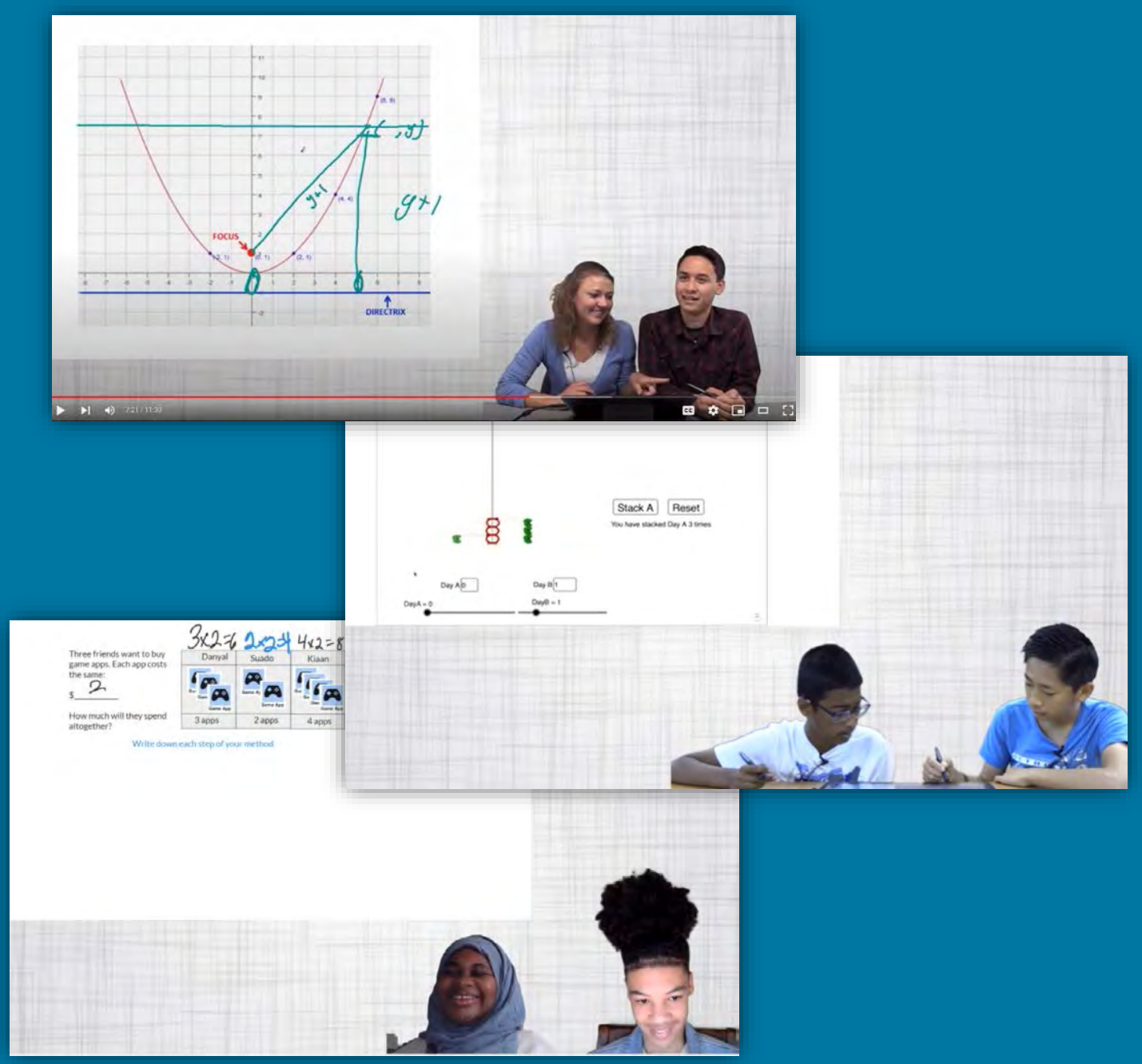
There are some online math videos that show students communicating their mathematical ideas

but they were filmed for teachers
not for student learning

Development Goal of Project MathTalk

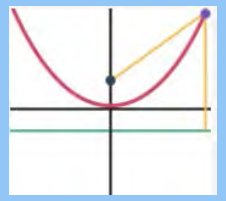
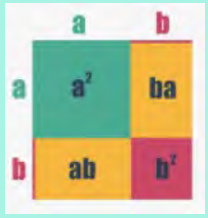
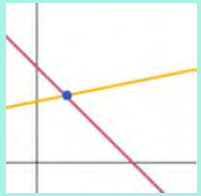
Create videos for Grade 7-12 students that feature pairs of students who

- explain and discuss their ideas
- convey authentic confusion
- persist to resolve mathematical struggles



MathTalk

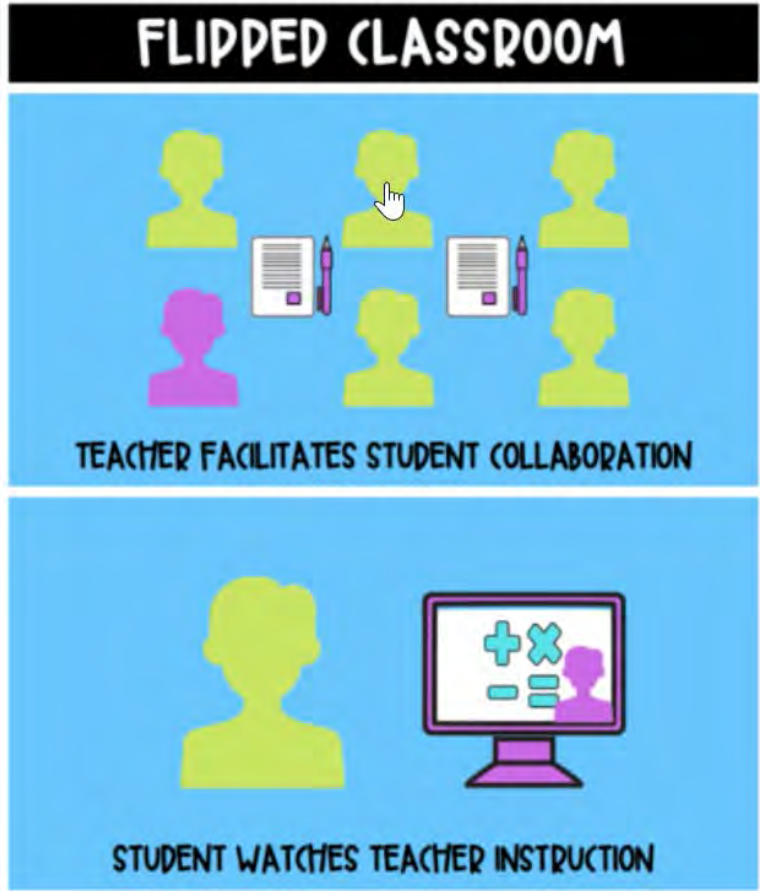
www.mathtalk.org

VIDEO UNITS					
Proportional Reasoning			**Parabolas**		**Previous Grant**
Algebraic Expressions			**Exponential Functions**		**Current Grant**
Multiplying Binomials			**Trigonometry**		
Solving Linear Equations			**Logarithms**		
Each unit has about 7 lessons & 40 short videos					

Developing Alternative Models for Online Videos Can Be Important to Other Research Programs

Research on Flipped Classrooms

- Videos are typically expository and procedural
- Concerning because such videos can
  - reinforce common student misconceptions (Muller, 2008)
  - restrict the focus of subsequent classroom conversations (Cargile & Harkness, 2015)



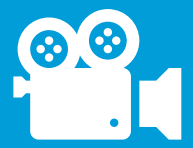
Developing Alternative Models for Online Videos Can Be Important to Other Research Programs

Research on Teacher (preservice and inservice) Learning

- Having access to the same students' learning over time and in a way that you can see their work, can have affordances for teachers
- Preservice secondary teachers using Project MathTalk videos developed deeper mathematical understanding and learned to decenter (distinguish student reasoning from their own and take on student perspectives); Walters (2017)

Design Decisions

Design Decisions



Use UNSCRIPTED rather than scripted student dialogue

Example from a MathTalk Video

- 3 minute video
- Algebraic Expressions Unit

Grade 9 students

Haleemah

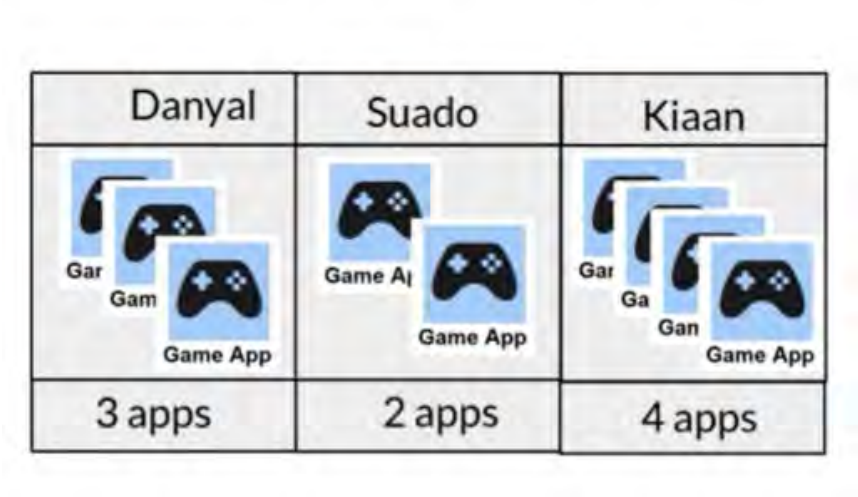
Elijah (ET)

Game App Task

Three friends want to buy game apps. Each app costs the same amount:

$\_\_\_\_$ unknown

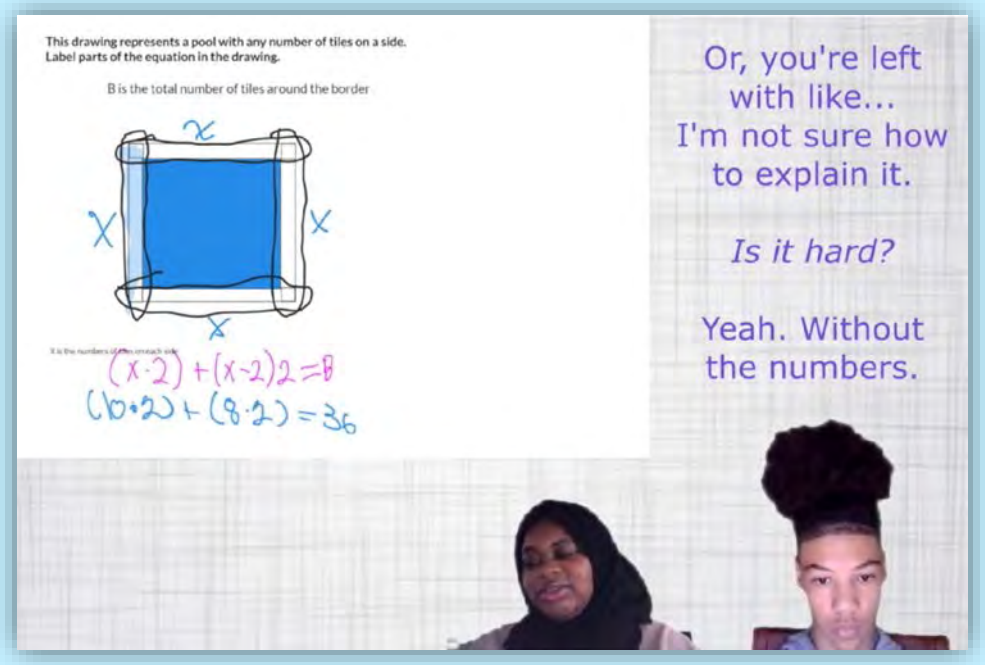
How much will they spend altogether?



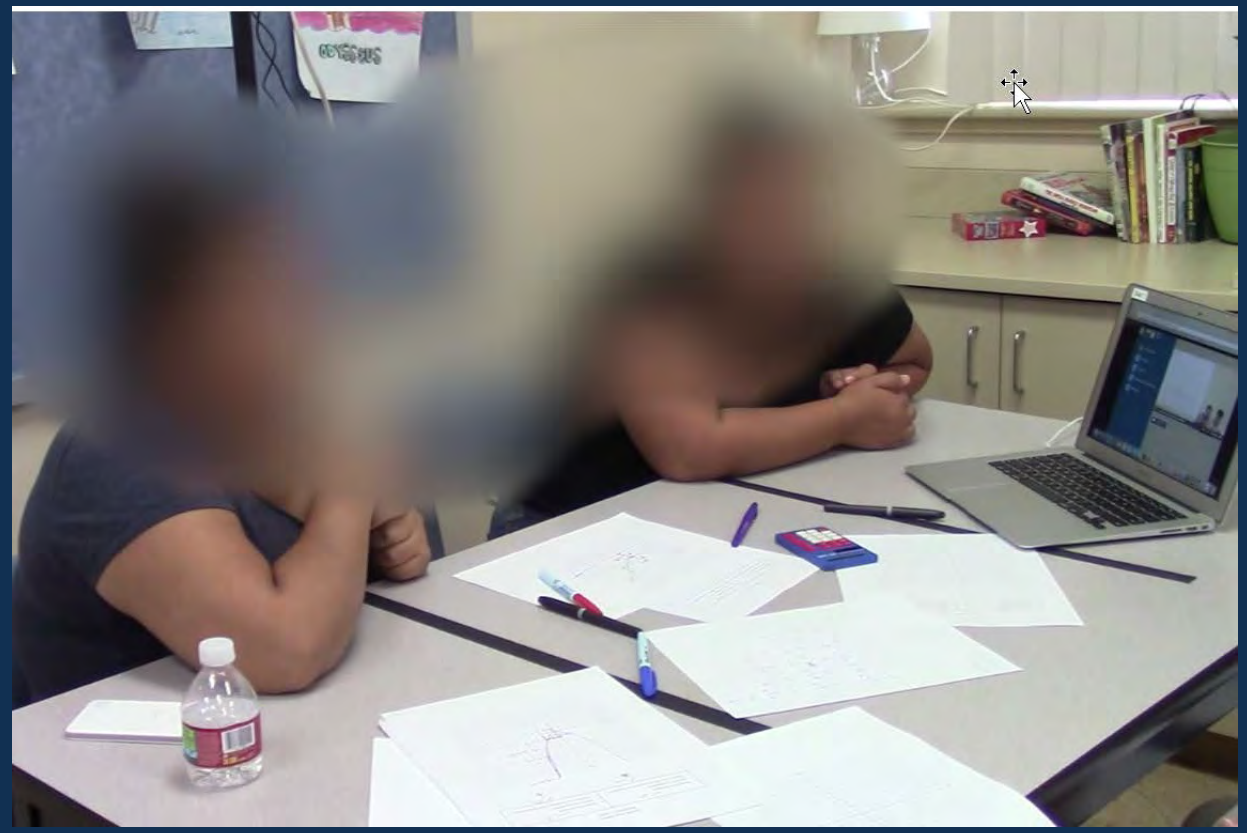
Unscripted Dialogue in Project MathTalk Videos

- Captures authentic student problem solving
- Often includes displays of confusion

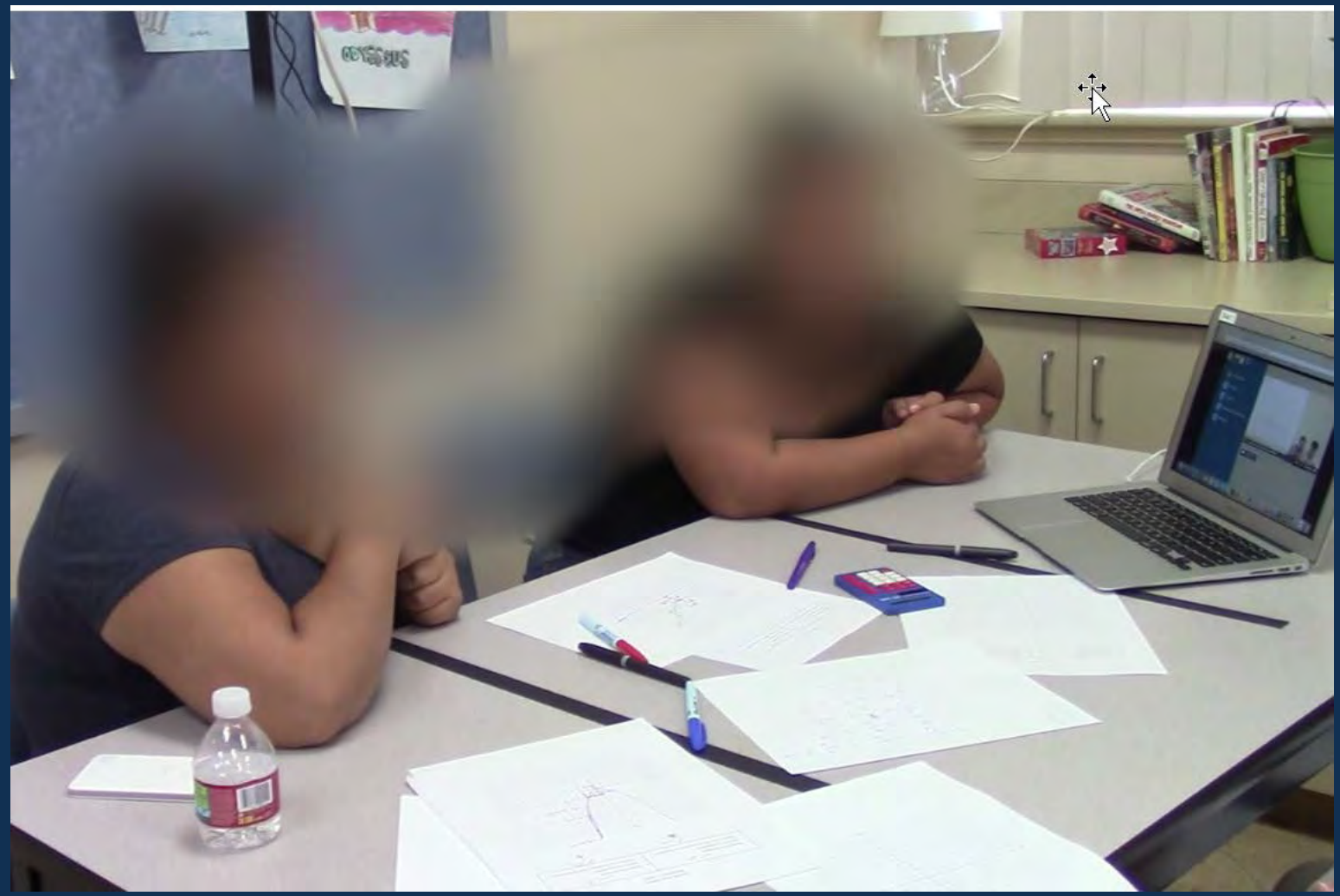
- We worried that viewers would find this confusion overwhelming
- But high schools students, in general, valued seeing the confusion of peers (Lobato & Walker, 2019)
- Believed they were struggling and learning together



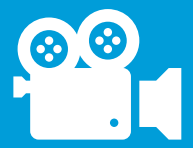
- 1 minute video
- Had just watched a video in which the students were quite confused
- Researcher asks if they would prefer to have videos without confusion
- They prefer “the confused ones”
- Listen for student to share how she feels like an “alien” in her math class when she’s confused



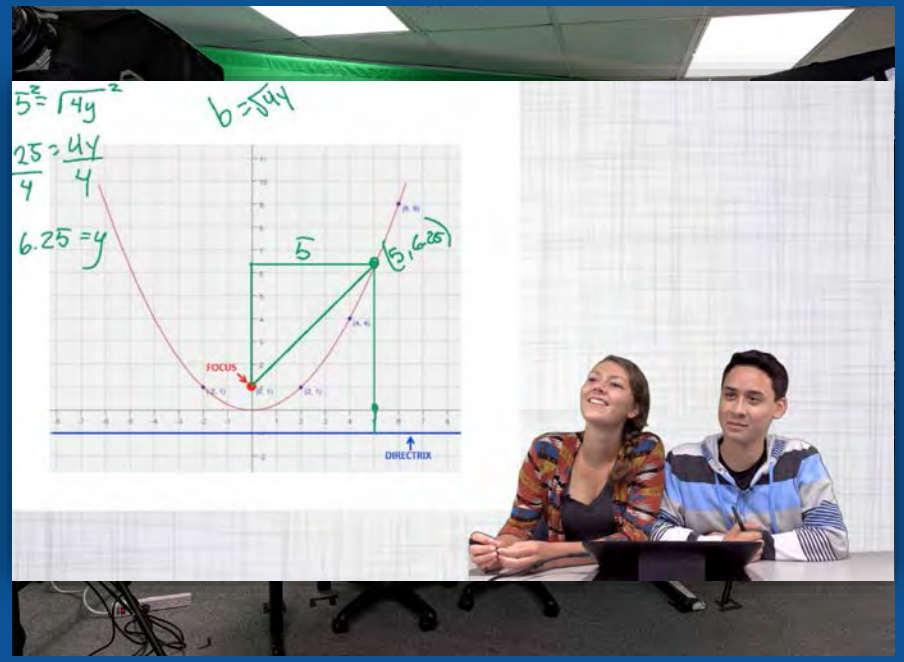
“When I get really confused, I get isolated, like I’m the only one, but then knowing that she’s [Sasha’s] confused too …we’re both confused.”



Design Decisions



Developed a protocol for filming remotely

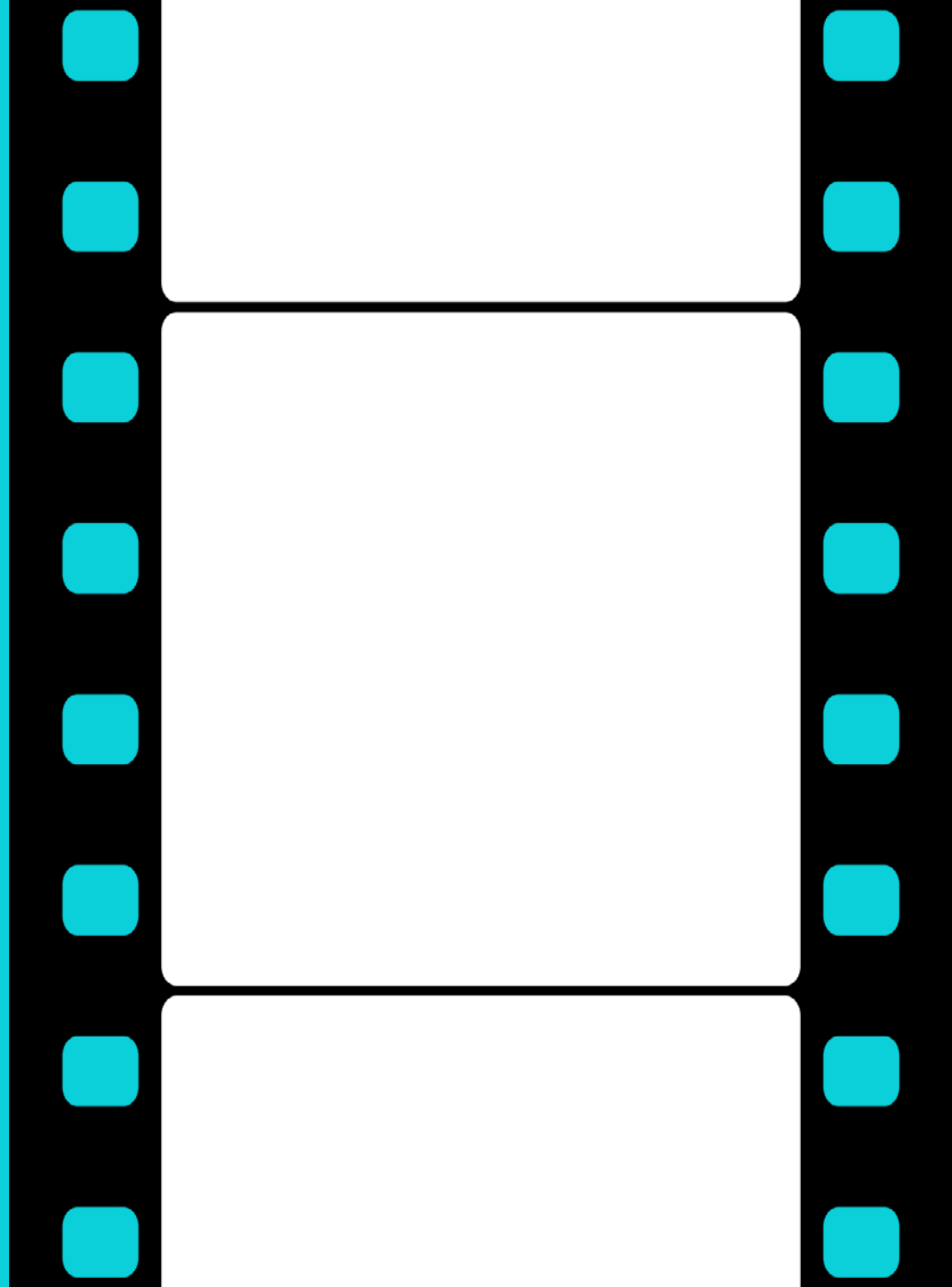

FOCUS
DIRECTRIX

Design Decisions

The inscriptions from the video participants need to be displayed clearly for other students to learn from them

Explain Everything

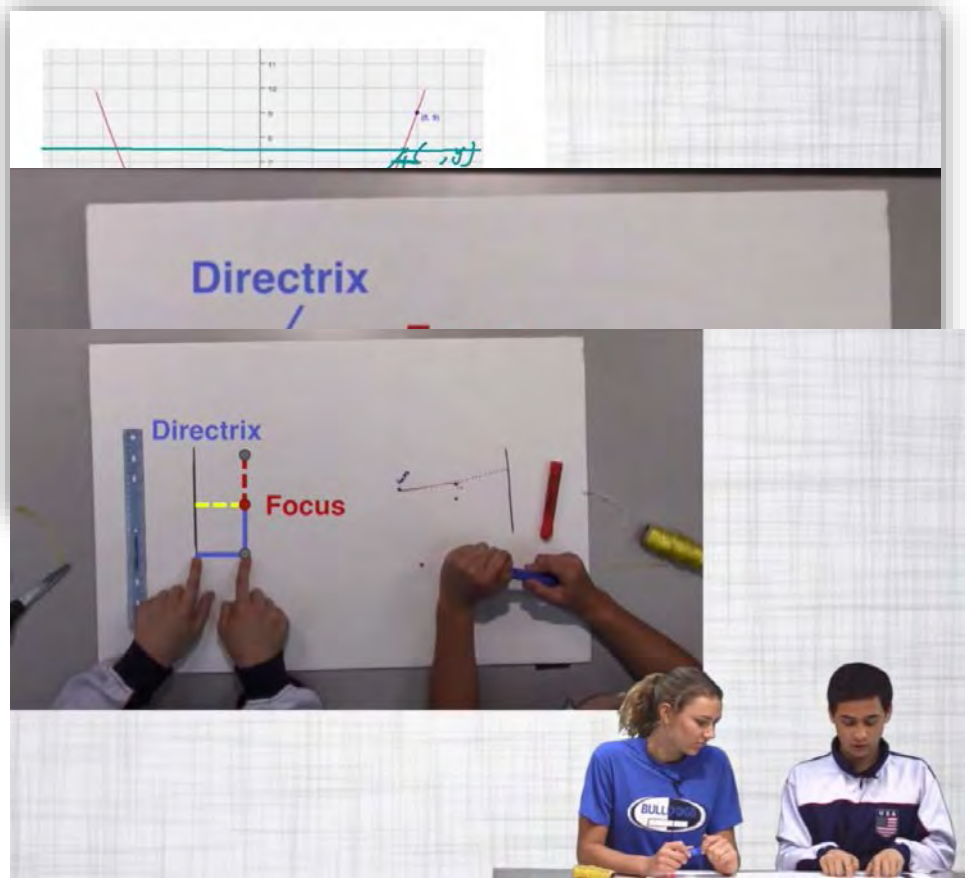
Lessons Learned about Using Video in Research & Development



Lessons Learned

1. The personality and nature of the relationship between the video participants matter

2. After focus testing different video prototypes, we learned that **annotating** and **summarizing** key parts of student work in the videos is important



Example from a MathTalk Video

- 1 minute video
- Parabolas Unit

Grade 9-10 students

Sasha

Keoni

Project MathTalk Team

- John Gruver, Co-PI
- Mike Foster, Doctoral Student
- Isabel White, Doctoral Student
- Mike McKean, Technical Specialist
- Alicia Gonzales, Post-Doctoral Researcher

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References

Cargile, L. A., & Harkness, S. S. (2015). Flip or flop: Are math teachers using Khan Academy as envisioned by Sal Khan? *TechTrends*, *59*(6), 21-28.

Klinger, M., & Walter, D. (2022). How Users Review Frequently Used Apps and Videos Containing Mathematics. *International Journal for Technology in Mathematics Education*, *29*(1), 25-35.

Lobato, J., & Walker, C. (2019). How Viewers Orient Toward Student Dialogue in Online Math Videos. *Journal of Computers in Mathematics and Science Teaching*, *38*(2), 177-200.

Lobato, J., Walters, C., & Walker, C. (2016, April). Beyond the demonstration of procedures in YouTube-style math videos. Paper presented at the NCTM Research Conference, San Francisco, CA.

Muller, D. (2008). *Designing effective multimedia for physics education* (Doctoral dissertation, University of Sydney Australia). Retrieved from http://www.physics.usyd.edu.au/super/theses/PhD(Muller).pdf

Walters, C. D. (2017). The development of mathematical knowledge for teaching for quantitative reasoning using video-based instruction. (*Doctoral dissertation, San Diego State University and University of California at San Diego).* Retrieved from https://escholarship.org/uc/item/8484s8zf