

Seeing things differently: a form and function analysis of student-generated dynamic data visualizations



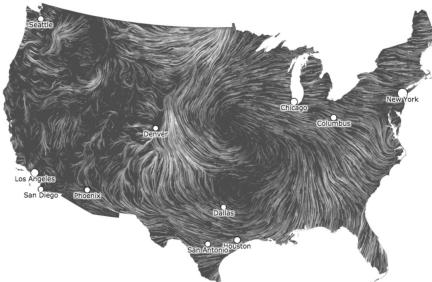
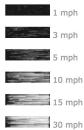
Vasiliki Laina (vlaina@berkeley.edu)
Michelle Wilkerson (mwilkers@berkeley.edu)

Why “dynamic data visualizations?”

wind map

March 18, 2019
3:22 pm EST
(time of forecast download)

top speed: 22.5 mph
average: 7.5 mph



Why do buses bunch?

INSTRUCTIONS EXPLANATION

Click and hold a bar below to delay its respective bus. Note how even a short delay causes the buses to bunch together after a while.

Hover over a stop to see its history. The area of the curve is cumulative wait time. Bunching makes the area grow.

PAUSE

RESET

bus 1 6 passengers

bus 2 6 passengers



What's Really Warming the World?

By Eric Roston and Blacki Migliozzi | June 24, 2015

Skeptics of manmade climate change offer various natural causes to explain why the Earth has warmed 1.4 degrees Fahrenheit since 1880. But can these account for the planet's rising temperature? Scroll down to see how much different factors, both natural and industrial, contribute to global warming, based on findings from NASA's Goddard Institute for Space Studies.



“16 Captivating Data Visualization Examples”

<https://blog.hubspot.com>

Constructing knowledge with dynamic data visualizations

- ❑ Epistemic forms: structures that help organize & create new knowledge (e.g. lists, tables, graphs)
- ❑ Epistemic games: the process & practices involved in creating an epistemic form

(Collins and Ferguson, 1993)

Dynamic data visualizations are new **epistemic forms**. The process of creating one is a new **epistemic game**.

Supporting epistemic games with epistemic forms

- ❑ The computational environment was not well aligned with the epistemic games some students were interested in when creating a simulation.
- ❑ This misalignment led students to struggle with the construction of a model.

(Wilkerson et al., 2018)

Supporting epistemic games with epistemic forms

- ❑ Tasks and instructional supports need to be open to a variety of solutions and representational forms in order to support successful student engagement.

(Lehrer & Schauble, 2010)

Research question

What perceptions of the nature and purpose of data visualizations do middle school learners reveal when designing their own data visualizations?

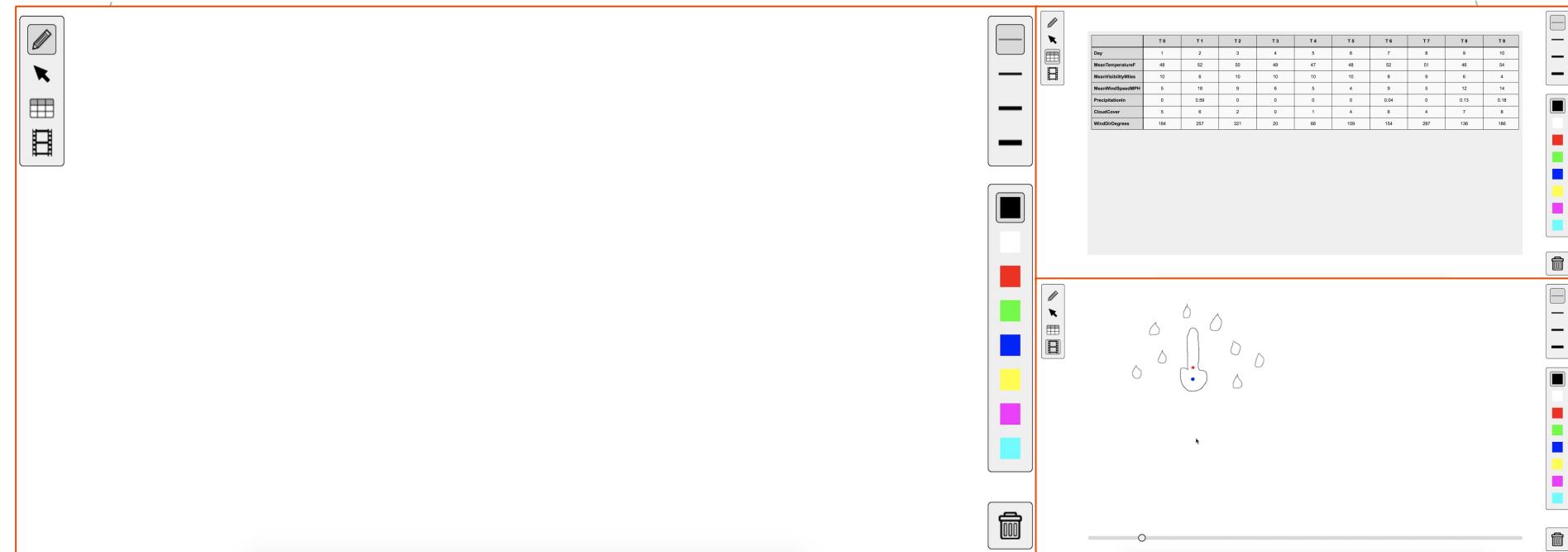
Methods

- Longitudinal semi-structured interviews
- 9 students, ages 10-14 (6 F, 3 M)
- 3 Interviewers, each interview ~60 minutes long
- Interviews included questions about:
 - Sensemaking with publicly available data visualizations (Interviews 1 & 2)
 - Sensemaking with student-generated data visualizations using DataSketch (Interviews 2 & 3)
- Video or audio recorded interviews
- Recorded screen activity
- Collected any physical drawings or notes

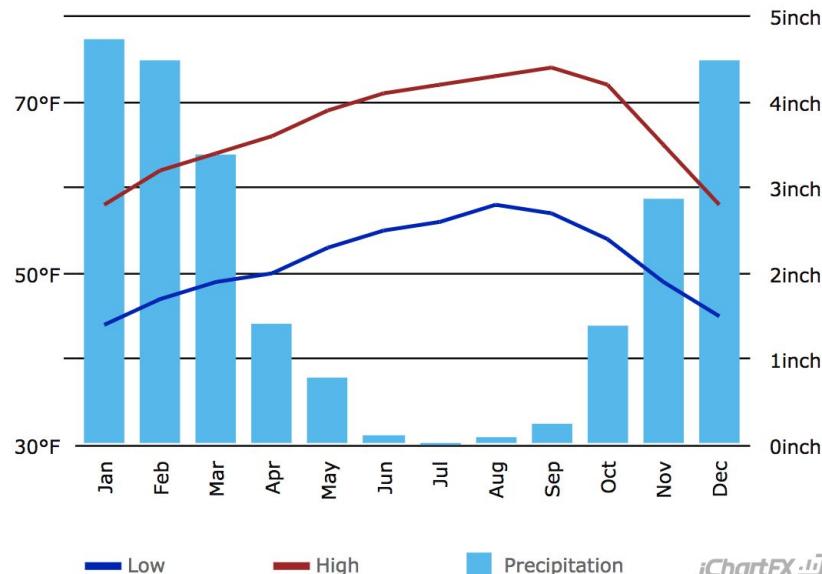
Data Analysis

- ❑ Detailed activity logs of moments when students expressed what they wanted to achieve and why.
- ❑ Systematized our analysis by paying attention to form and function (Saxe, 1994) markers in students' sketches.
- ❑ Supplemented interpretations with analysing student discourse.
- ❑ Current analysis focuses on Interview 2.

DataSketch



The task



Exploring relationships

"Actually I think that **highest temperature and max wind gust would be better to compare together.** [...]

Well I guess, actually that doesn't make sense.

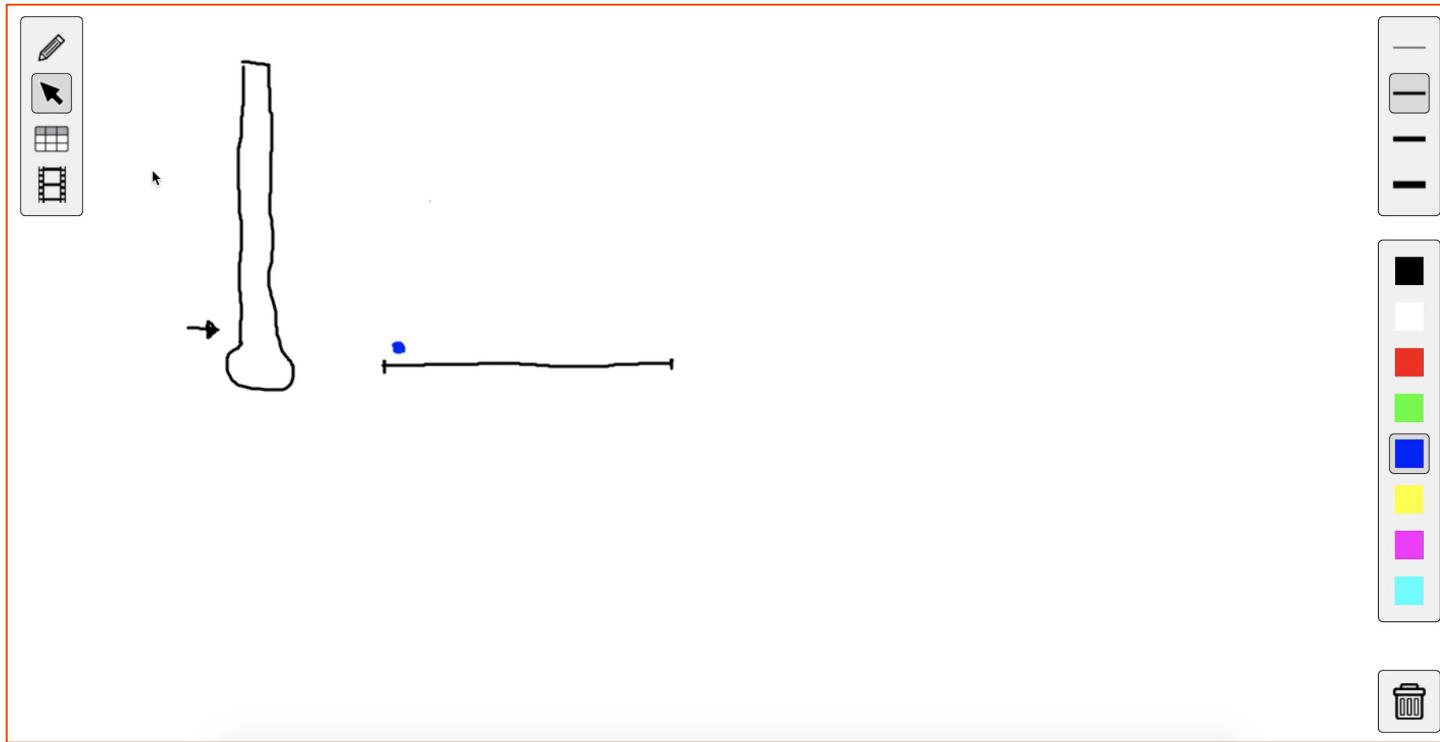
Because the aver-, or the, highest temperature and max wind gust wouldn't happen at the same time. [...]

Exploring relationships

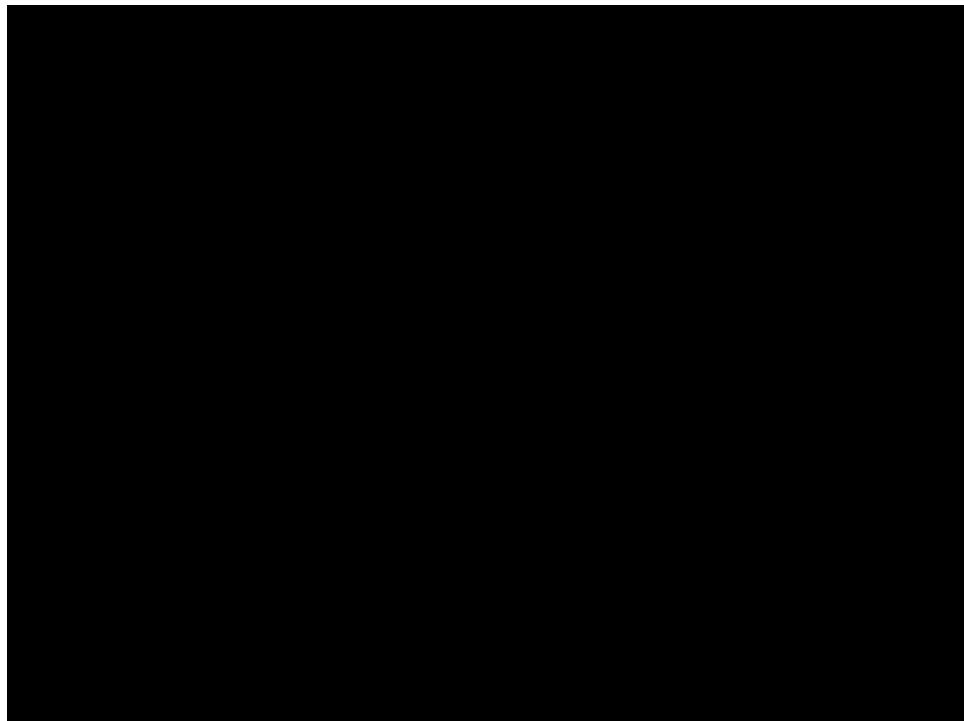
"Actually I think that highest temperature and max wind gust would be better to compare together. [...] Well I guess, actually that doesn't make sense. Because the aver-, or the, **highest temperature and max wind gust wouldn't happen at the same time.** [...]

No, [I will do] the **lowest temperature and max wind gust. Cause the max wind gust might have caused the lowest temperature?**"

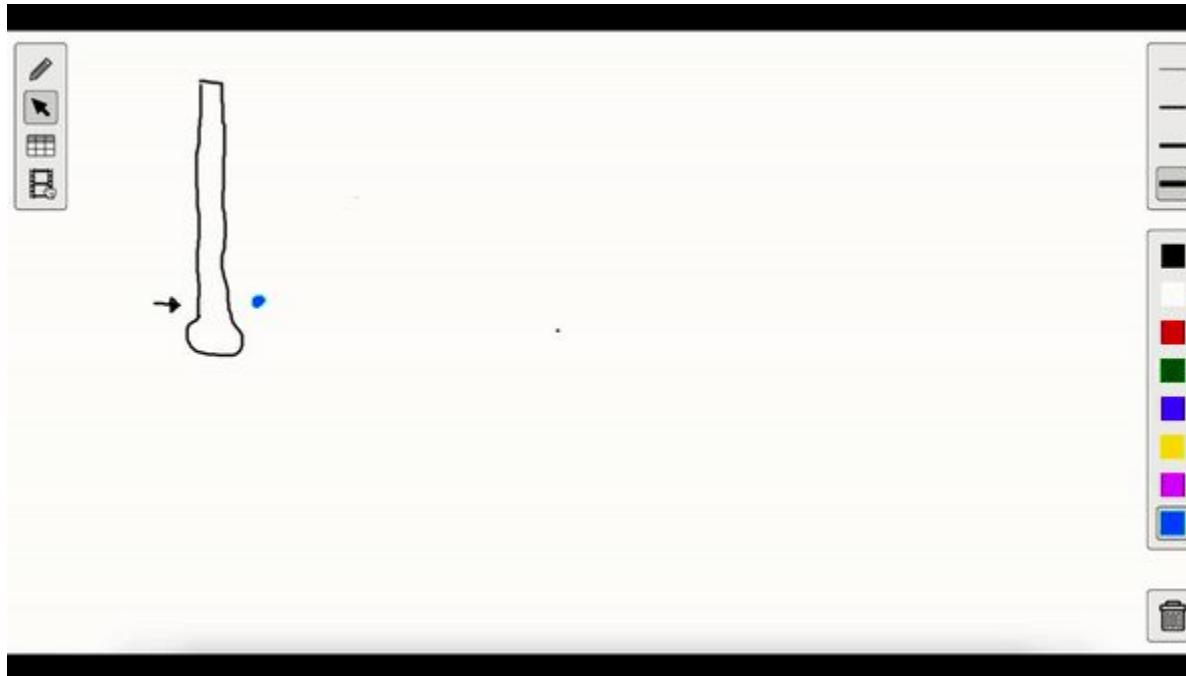
Exploring relationships



Exploring relationships

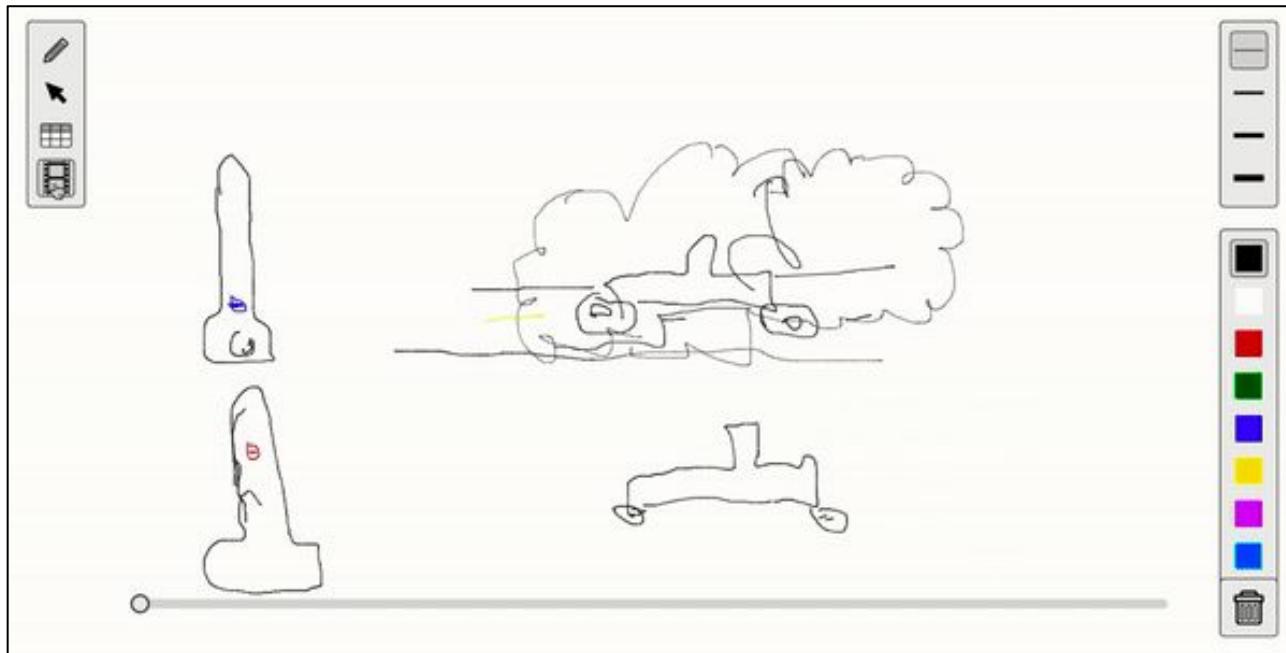


Exploring relationships

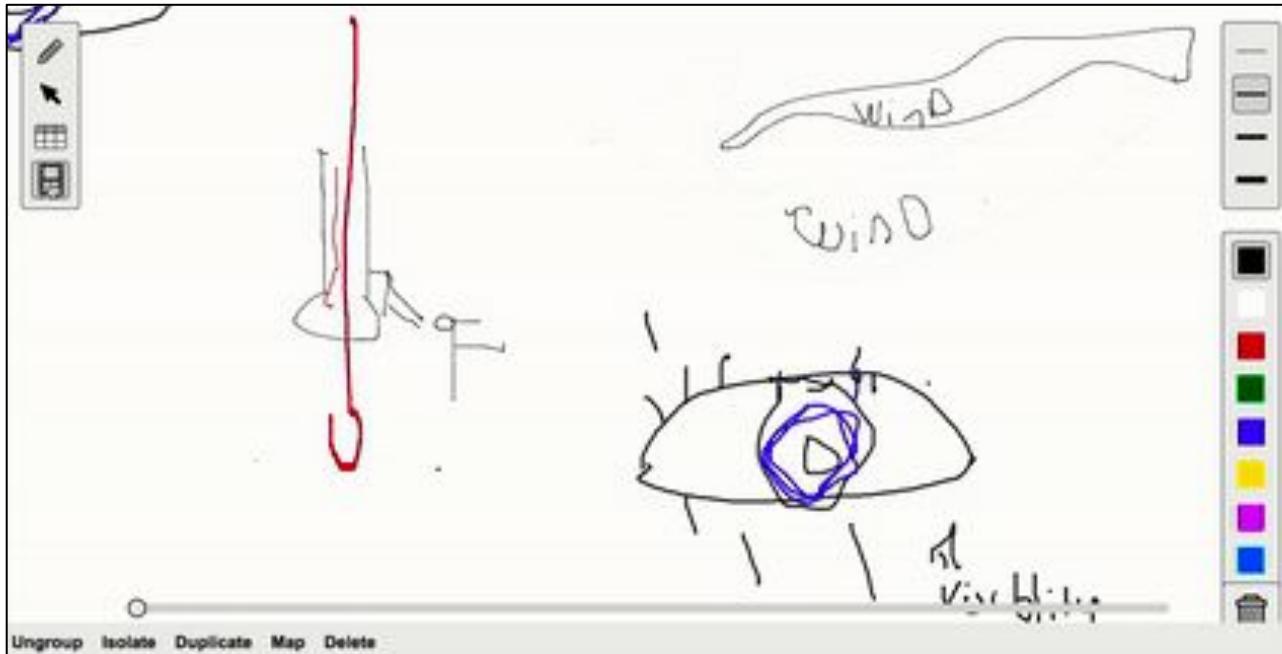


Daisy

Communicating implications of the data

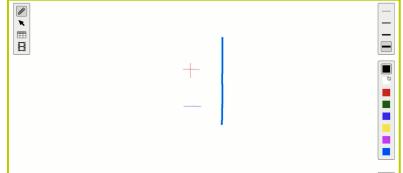
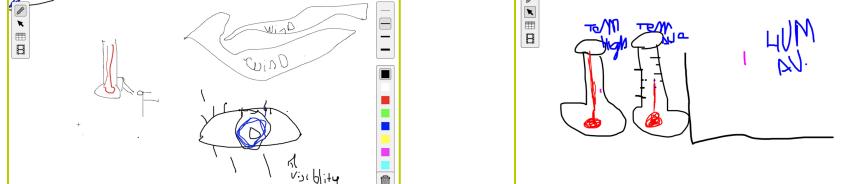
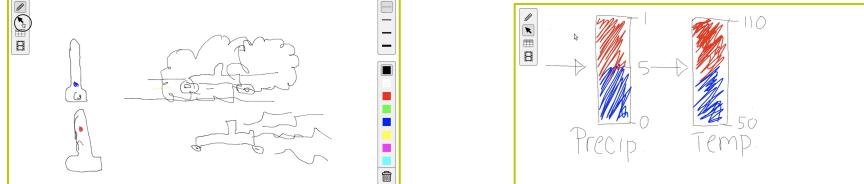
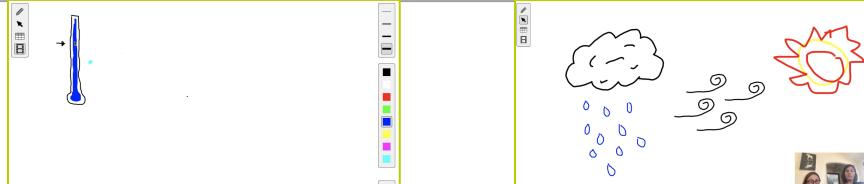


Communicating the system



Adar

Findings

Epistemic goal	Student(s)	Sketches
Communicating the data	Nelly	
Communicating the system	Adar, Bella, Timothy, Carol	
Communicating implications of the data	Cid, Fatma	
Exploring relationships in the data	Daisy, Carol	
Rejection of data or tool	Louiza	

Implications

- ❑ Implications for assessment depending on visual attributes based on perceived epistemic goals.

Future Work

- ❑ Looking at perceived purposes of publicly available dynamic data visualizations
- ❑ Integration of data visualizations into a larger multimodal narrative in a classroom setting.

Thank you!

Vasiliki (Vicky) Laina,
Michelle Wilkerson,

vlaina@berkeley.edu
mwilkers@berkeley.edu

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