We Can't Just Go Shooting Asteroids Like Space Cowboys: Teaching and Learning with Immersive, Interactive Projection

Vanessa Svihla[1], Nicholas Kvam[1], Jeffrey Bowles[1], Joe Kniss[1], & Matthew Dahlgren[2]

[1]University of New Mexico;

[2]Basis Charter School, Phoenix

6/13/2013

Immersive displays > standard desktop displays

- factual recall and conceptual learning:
  - environmental science (Schloss, Jacobson, Handron, & Hampshire)
  - earth science (Sumners, Reiff, & Weber, 2008)
  - architecture (Jacobson, 2010)
  - chemical reactions (Limniou, Roberts, & Papadopoulos, 2008)
  - Mayan culture and astronomy (Heimlich, Sickler, Yocco, & Storksdieck, 2010)
  - mental rotation skills (Ganskop, 2010)

DomeGL = real-time interactivity

- developed an OpenGL software platform
- real-time rendering for multiple projectors displaying in dome environments without distortion
- opens up new possibilities for learning
  - (Emmart, 2005; Wyatt, 2005)

Role-play

- learn science practices
  - (Solomon, Duveen, Scot, & McCarthy, 1992; Barab et al., 2010; Hickey, Barab, Ingram-Goble, & Zuiker, 2008)
- develop identities as scientists
  - (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005; Clarke & Dede, 2005; Dawley & Dede; Dunleavy, Dede, & Mitchell, 2009; Mikropoulos & Natsis, 2011)
- mediator between virtual and real identities
  - (Gee, 2003)
- engaging students previously uninterested
  - (Dunleavy et al., 2009)

foci

- How might immersive, interactive media + role play support learning of STEM *designerly* practices -- posing questions, designing investigations, modeling data?

- How might adding narrative context help?

methods

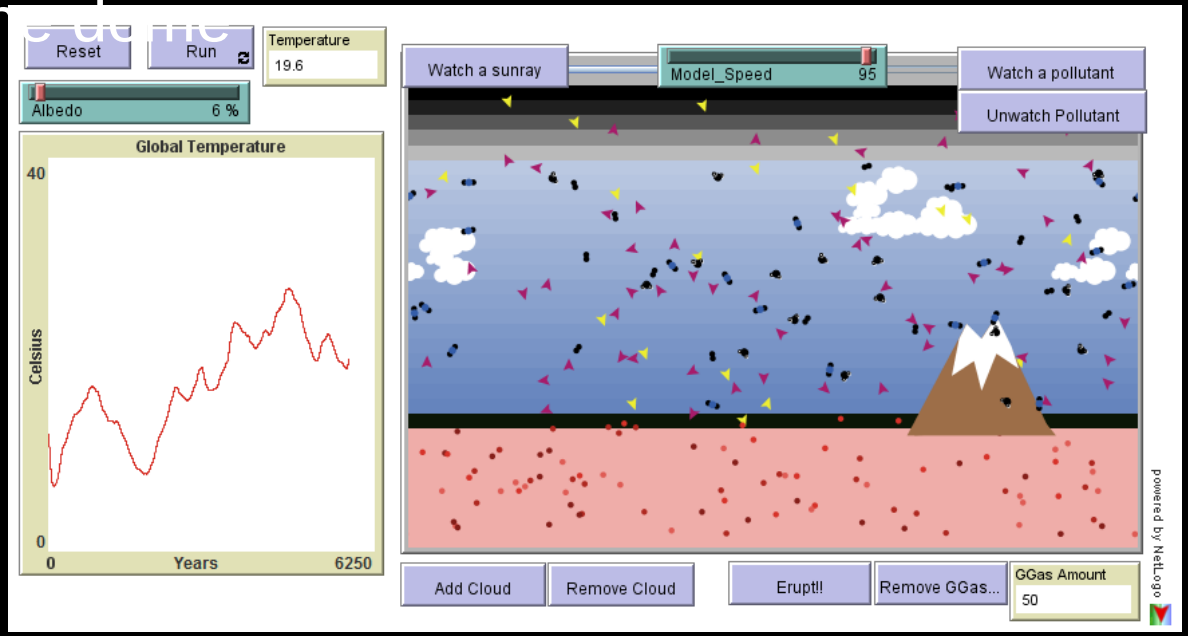
- ClimateDome: secondary science teaching methods (n=8)
- DomeStroids: mathematics for elementary teachers (n=9)
- teacher co-designed with computer science student, with feedback from the team
- 1st cycle, design-based research
  - design goals: immersive, interactive, inquiry lessons
  - theory goals: local notion of reconfiguration/disruption
- video records: interaction analysis
- artifacts: grounded coding

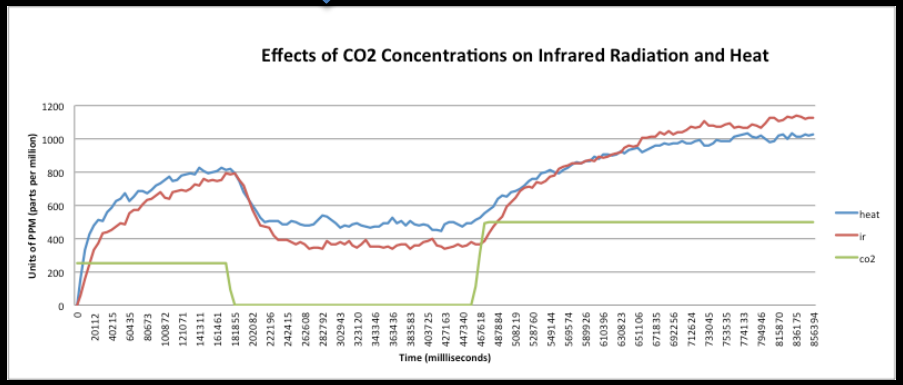

ClimateDome

Students studied a problem-based WISE unit on climate change then went to th

Role-play, no narrative

They returned to class with data from their experiments





Modeling data surfaced many questions about relationships between variables

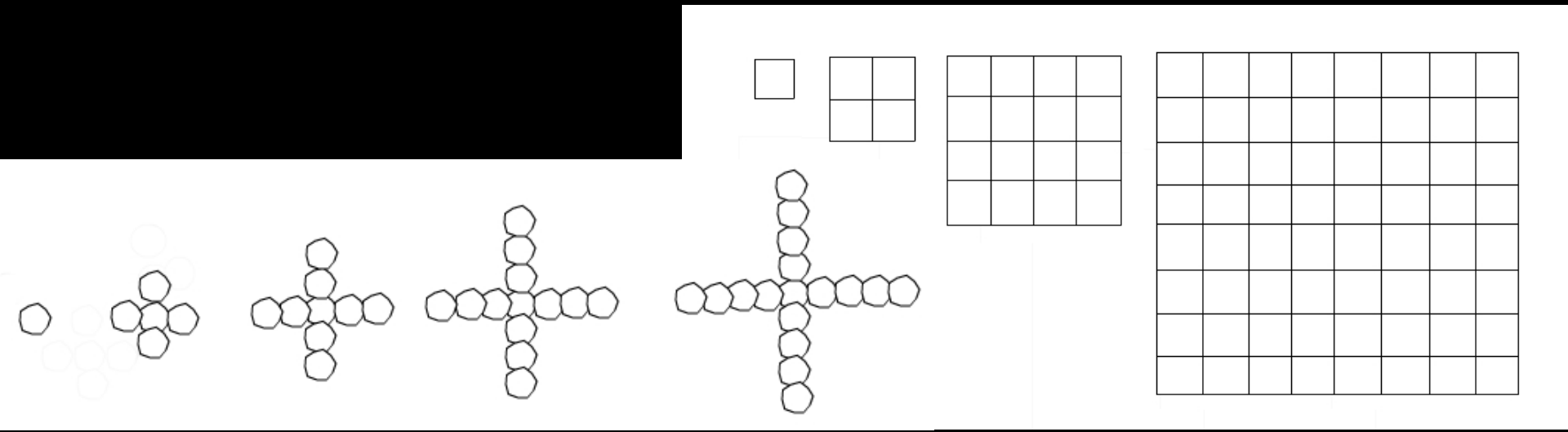
Narrative

- Provides coherence, context, situated experience, allows learners to construct meaning
  - (Bruner, 1991; Dede, 2009; Hazel, 2008)
- Provides a motivating context for problem solving
  - (Dickey, 2006)
- means to support struggling students
  - (Waraich & Brna, 2008)


DomeStroids

arithmetic and geometric sequences

- narrative context: asteroids are headed to destroy earth, but a cancer researcher proposed a new weapon, based on cell division
- each strike divides asteroid into 3 pieces, resulting in a sequence
- topic has had low success rate in past



“We Can't Just Go Shooting Asteroids Like Space Cowboys”

Mr. D: Wull:: ‘cause one became three right so actually we only added (.)

Ss: Two

Mr. D: Two more so how many did we have?

Ss: 22

Mr. D: 22. Okay and then we did it again. We fired again. How many did we have after that?

Ignacio: So would there be a formula- would be like uh the number of asteroids minus (.) minus one when it splits into three

Mr. D: You're getting kind of the right ide-. I'm not sure what you're saying

Ignacio: Minus one times two

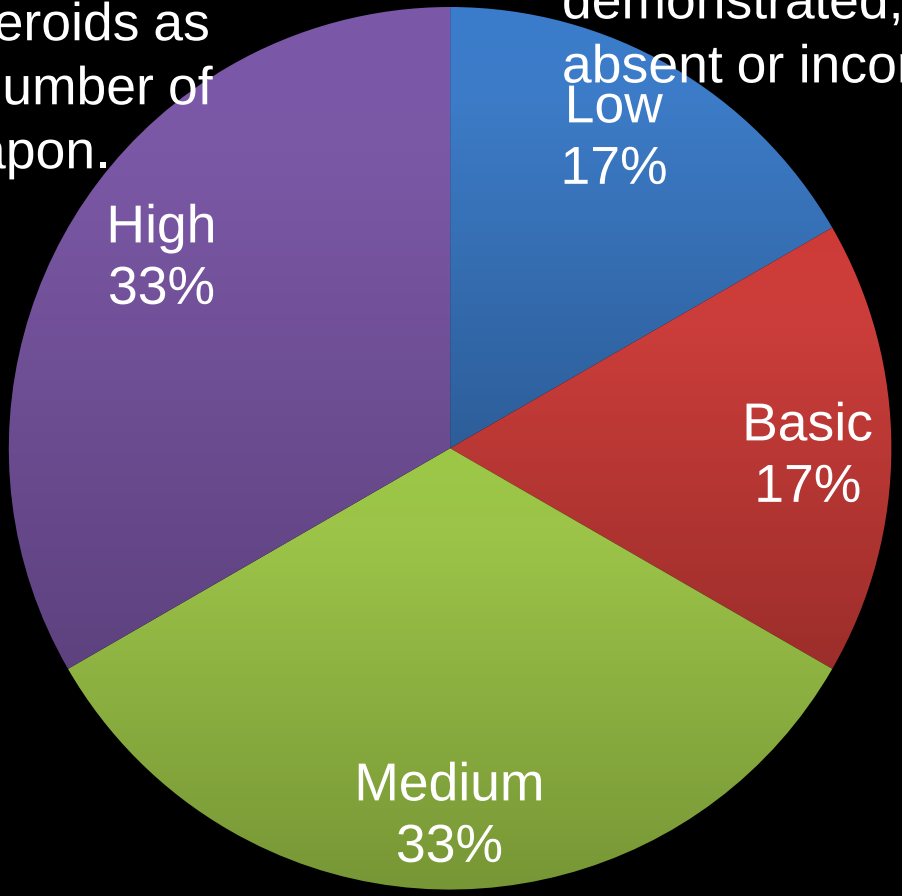
Mr. D: No not times two //

Ignacio: //plus two

Mr. D: (.) You're almost there you're almost there. (.) Can anybody help him out. What do you guys think the formula for this thing

Clear understanding of sequences and pattern; includes entire formula for the number of asteroids as a function of the number of strikes by the weapon.

No understanding of sequences or pattern demonstrated; formula is absent or incorrect.



Missing important details about sequences or pattern but includes non-trivial explanation; reasoning unclear; formula is absent or incorrect.

Partial understanding of sequences and pattern; missing details; formula includes extraneous information or lacks explanation of reasoning

findings

- ClimateDome
  - students engaged as scientists
  - surfaced questions
  - patterns of participation intact
- DomeStroids
  - narrative context pervaded interactions
  - students learned sequences
  - invited participation from students who rarely participated

thanks!
questions?
vsvihla@unm.edu

This research is supported by an Interdisciplinary Research grant from the College of Education in cooperation with the Office of the Provost, University of New Mexico. Additional funding provided by the School of Engineering and the College of Fine Arts.

We also acknowledge prior NSF funding (PFI #917919) for the technology development.

UNM

IDDEA lab

ARTS LAB Art Research Technology Science