RESEARCH + PRACTICE COLLABORATORY

Adapting Curriculum to Support Academically Productive Talk in Science

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This material is based upon work supported by the National Science Foundation under Grant Numbers DRL-0822314 and 1238253. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Academically Productive Talk

Definition: Talk that supports supports reasoning and deepen student understanding of complex material (Michaels & O'Connor, 2011)

Academically productive talk is an essential part of multiple science and engineering practices.

Academically Productive Talk

*Academically productive talk is **accountable** to:*

- **the learning community:** Attending to and building on the ideas of others
- **standards of reasoning:** How claims are warranted, grounded in disciplinary practices
- **knowledge:** Based on publically accessible texts, evidence, and records of student dialogue and work

Talk Moves in Science

Checklist

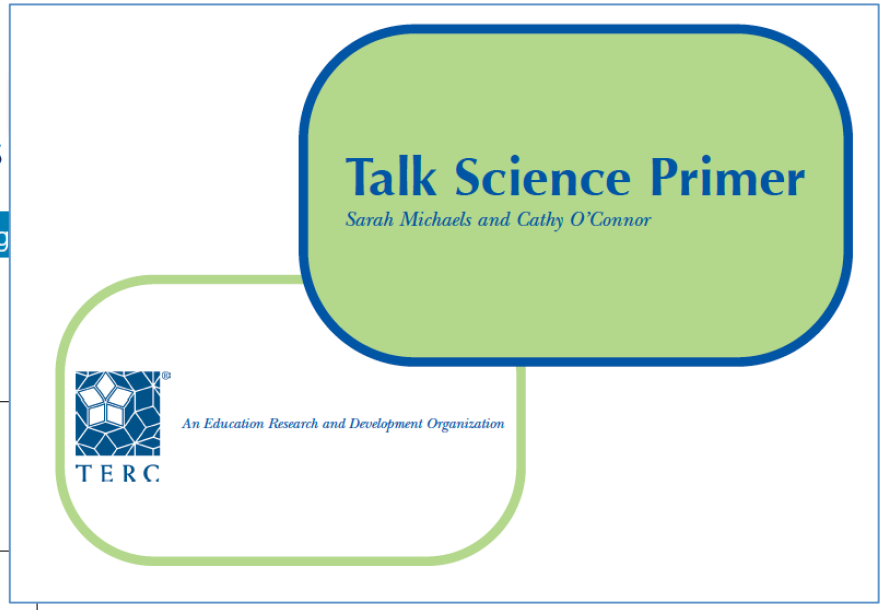
Goals for Productive Discussions and Nine Talk Moves

Goal One Help Individual Students Share, Expand and Clarify Their Own Thinking

☐ **1. Time to Think**
- Partner Talk
- Writing as Think Time
- Wait Time

☐ **2. Say More:**
"Can you say more about that?"
"What do you mean by that?"
"Can you give an example?"

☐ **3. So, Are You Saying…?:**
"So, let me see if I've got what you're saying. Are you saying…?"
(always leaving space for the original student to agree or disagree and say more)



Talk Science Professional Development (Free)

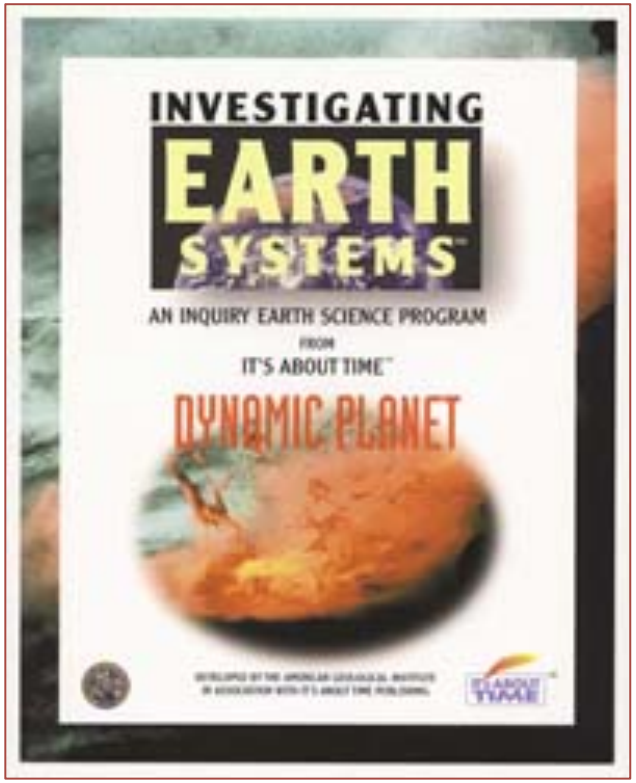
http://inquiryproject.terc.edu/prof_dev/pathway/

Contingent Pedagogies

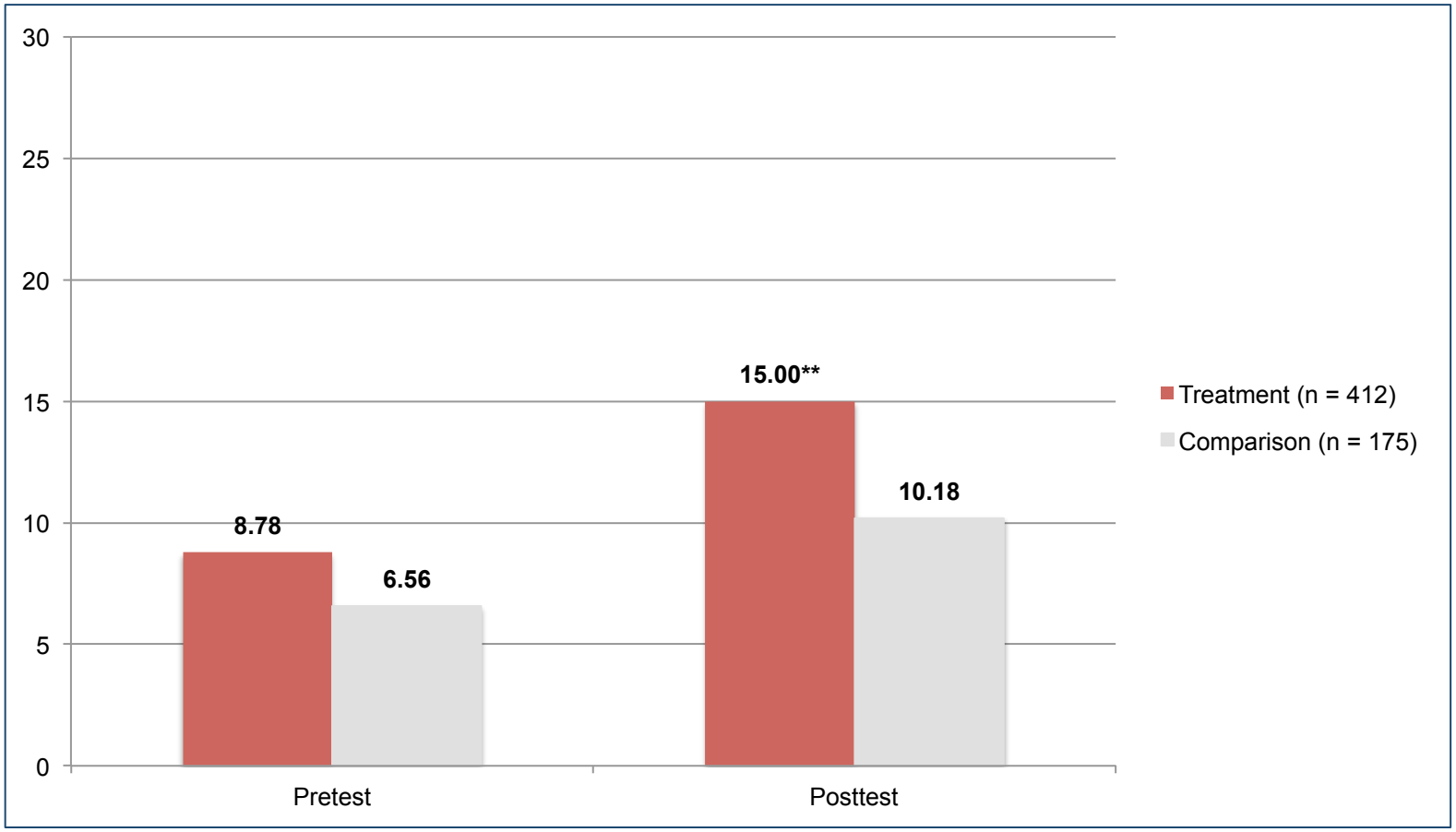
- Four-year NSF-funded project to investigate the potential of classroom network technologies to support classroom assessment in middle school Earth science
- Anchored in *Investigating Earth Systems* curriculum materials
- Developed in partnership with teachers from Denver Public Schools

Curriculum

- Began with Denver Public Schools' adopted middle school Earth science curriculum: *Investigating Earth Systems*
- Units are investigation-based
- Contingent Pedagogies activities replaced opening discussion and review
  - Aim: to augment opportunities for students to make connections between investigations and core ideas.



Results of Study: Rocks and Landforms Test



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Facets Approach

- Descriptions of students' thinking as it is seen or heard in the classroom or other learning situation
- Only slight generalizations from the ways students speak and reason about big ideas.
- Facets can be organized into clusters that correspond closely to big ideas.
  - Goal Facets
  - Problematic Facets

Goal Facets

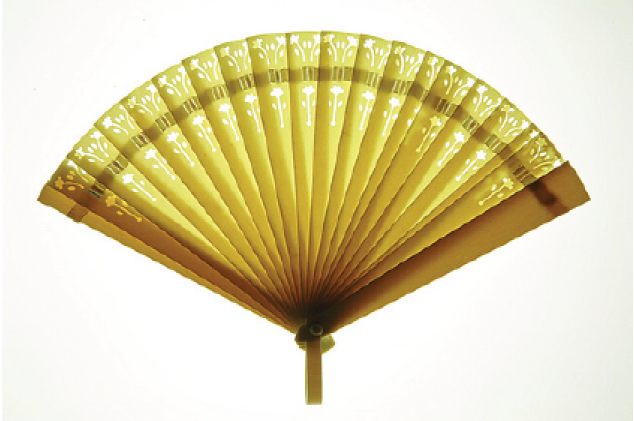
00		**Landforms change naturally over time when more material is removed from an area than supplied to the area (erosion) and when more material is supplied to an area than is taken away (deposition).**
	01	The force of gravity causes rocks/particles to migrate toward the lowest surface possible. Material tends to accumulate where the land is flatter.
	02	Moving water, and to a lesser extent, wind, act to transport Earth's particles from one location on the landscape to another.
	03	Other things being equal, the heavier/bigger the particles, the slower they will be moved by water or wind.
	04	Other things being equal, the faster and the greater the volume of flowing water or moving air, the faster the water or air will move the particles.

Problematic Facets

Less Problematic Facets

30		Students think that only water causes changes to landforms.
40		Students do not recognize the role of gravity in erosion.
	41	All sediment travels the same speed and distance regardless of slope.
	42	Deltas form because water needs to room to flow and has space to flow into the ocean.
	43	All sediment in rivers ultimately ends up in the ocean.
60		Students think that the effects of erosion are always immediate.
70		Students think that erosion only happens due to large-scale catalysts (e.g., floods, hurricanes).
80		Landforms are only destroyed (not created) by erosion.
90		Students confuse weathering and erosion.
	91	Students think that weathering and erosion are one process.
	92	Students think that erosion is the breaking down of rocks.

Clickers



The green areas marked above show the place where a river flows into an ocean. Why does this river look like a triangle (or fan) where it flows into the ocean? *Be prepared to explain your response.*

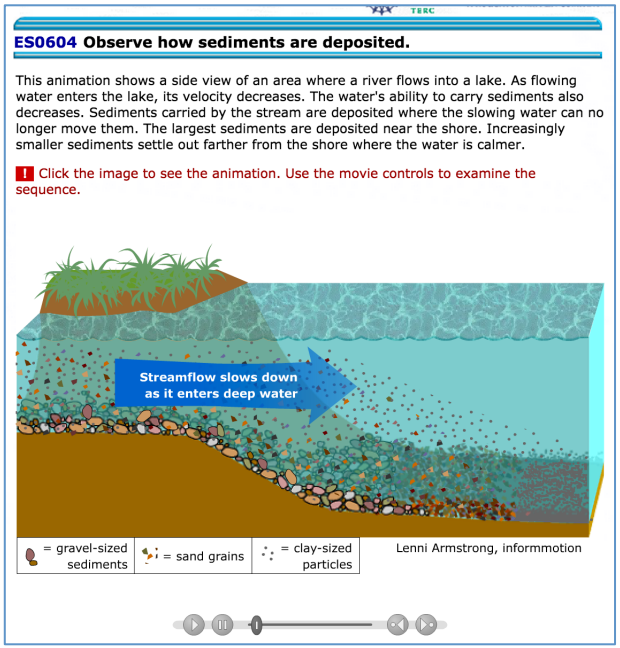
A. Sediment is settling there as the land becomes flatter.
B. The water can flow all over the place just before it meets the ocean.
C. The river is transporting sediment to the ocean.
D. Finer sediments suspended in the water are being deposited there.

Supporting Teacher Decision Making

- Provides teachers initial feedback on the distribution of student ideas in the classroom.
- Depending on the prevalence of particular problematic ideas or forms of reasoning and their persistence in subsequent class discussion, teachers can choose to use a "contingent activity" that provides a different way of presenting a disciplinary core idea.

Contingent Activities

- Provide means to work through models together.



Source: Classzone

STEP 5. Ask students to make a prediction about deposition patterns.

Distribute a copy of the following picture to students. (Alternatively, a diagram showing where a river enters a large body of water can be distributed to students).

Working in groups, students respond to the following prompt.

Source: http://en.wikipedia.org/wiki/River_delta

In this picture, where would you expect to find gravel? Where would you expect to find sand? Clay?

Label the image to indicate the locations for gravel, sand, and clay.

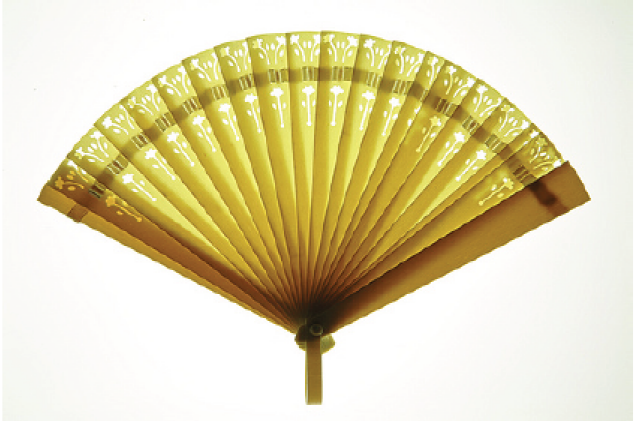
Write a 2-3 sentence explanation for why you would expect to find gravel, sand, and clay at the locations you have marked in your diagram.

A Pedagogical Pattern

Engages students with integrated nature of science:

- **Disciplinary Core Ideas:** The Roles of Water in Earth's Surface Processes (ESS2.C)
- **Science and Engineering Practices:** Building and Using Models, Engaging in Argument
- **Crosscutting Concept:** Systems and System models

Question



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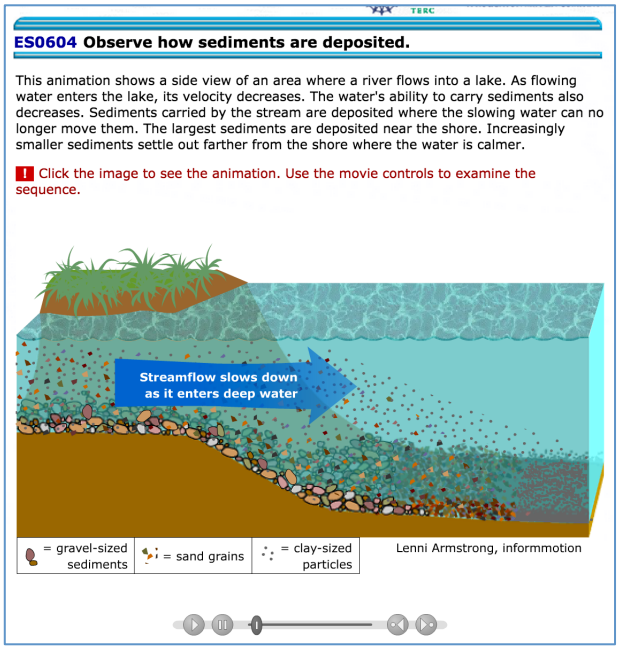
Participate in Cycle

- Students
  - Vote with colored cards
  - Discuss at tables, explain your thinking to others
  - Decide ahead of time who might share the group's thinking
- Teachers (2 per table)
  - Listen to the discussion for evidence of the facets: in What ideas here are you hearing? Are any other ideas being discussed?

Explore/Do Contingent Activity Together

Handout: *Deltas and Floodplains Qs and CAs*



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What's Reusable

Across content areas and curriculum materials:

- **Pedagogical patterns:** Sequences in the cycle for eliciting students' initial ideas, reviewing understanding, and interpreting and using models
- **Decision rules:** How to think about what to do next

Adaptation

Adapting materials can build capacity for NGSS.

- **Leaders:** Decide what existing parts of lessons in coherent materials to replace or change, in order to strengthen opportunities to engage students in academically productive talk
- **Teacher teams:** Developing new elicitation questions and facets
  - A way to organize study groups focused on interpreting student thinking

Resources Online

Facets-based questions
can be accessed online at:

http://contingentpedagogies.org

Workshop **slides and handouts:**

http://learndbir.org

Under: Resource Bundles > NSELA Workshop