Getting into Schools:
Building Bridges & Designing Activities with Teachers

Morgan Seag, Polar Studies, SPRI

Program Manager, Bay Area Scientists in Schools

CRS
COMMUNITY RESOURCES FOR SCIENCE
practical support for great science teaching

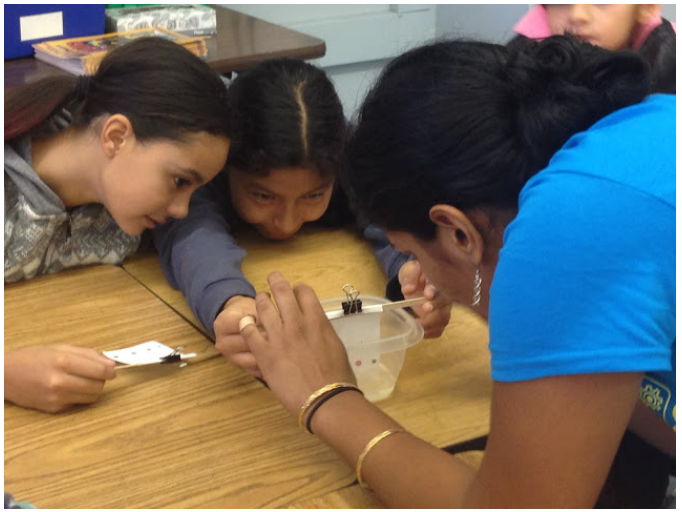
USAPECS
Association of Polar Early Career Scientists

Bay Area Scientists in Schools

- Scientists & engineers teach one-hour STEM lessons in elementary & middle schools
- BASIS Provides:
  - Science role models
  - Hands-on STEM experiences
  - Support/motivation to teachers
- 600+ active volunteers serving 1600 teachers and 12,000 students annually

Why Outreach in Schools?

- Broaden participation in science
- Invest in the future of science
- Invest in your career
- Strike a balance



Ways to get involved in schools

- **Classroom visits with hands-on activities**
- Afterschool programs
- Medium- to long-term mentorship
- Family science nights
- Science fair judging
- Remote visits
- Host a (virtual) field trip
- Teacher PD

Science Education Context

- Geographically specific
- Transitioning to the Next Generation Science Standards (NGSS)

"Old" way of teaching science	NGSS approach
Learning info from textbooks	Doing hands-on science; Analyzing real-world examples
What scientists know	What scientists do; How scientists think; What scientists learn
Content-driven	Question-driven
"Learning about"	"Figuring out"

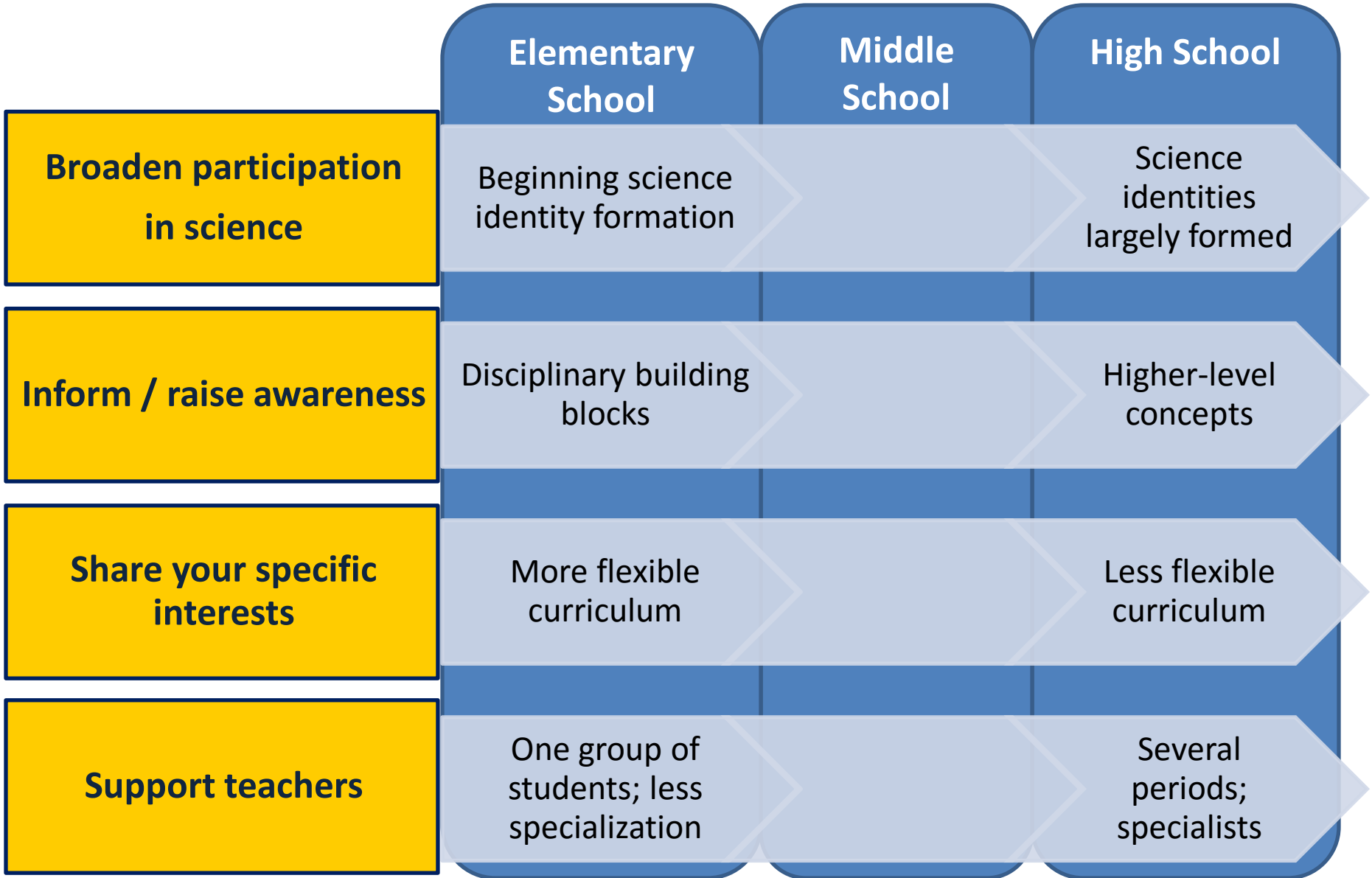
- States/districts in varying states of transition

Building Bridges with Teachers

- What are teachers generally looking for?
  - Scientist-student dialogue
  - Content support
  - Integration with curriculum (often NGSS)
  - Resources
  - Prepared scientist volunteers

- What can you offer?
  - One-off vs recurring
  - Personalized vs canned
  - No right answer!

What age group fits my outreach goals?



Building Bridges with Teachers

- Personal connections
- Campus resources
  - Existing in-school outreach programs in STEM
  - Existing in-school outreach programs in other fields
  - Teacher training programs
  - Student groups
  - Outreach or community partnership office
  - Public-facing institutions (museums, botanical gardens, etc.)
- Local school administration
- Local nonprofits / extracurricular programs
  - Afterschool programs
  - Scouts, YMCA, 4H Club, etc.

Map out your visit

I. Introduce yourself as a role model

II. Introduce your topic

   I. What do students already know?

   II. What background information do they need?

   III. Why should students care?

III. Facilitate a hands-on activity

   I. Investigations / Experiments / Games / Citizen science

   II. Guide students to **figure something out**

   III. Be clear about WHY students are doing each aspect of the activity

IV. Wrap-up with real world connections

   I. Why should students care?

http://www.crscience.org/lessonplans/BASIS_LessonTemplate.docx

Designing Hands-On Activities

1. Clarify your goals
2. Scan state science standards (or www.nextgenscience.org)
3. Break down your goal into age-appropriate concepts
   - 3rd Grade NGSS: interdependent relationships & ecosystems
   - 5th grade: energy cycle from sun to human food
   - Middle school: solutions to maintain biodiversity
   - High school: ecosystem stability, human impacts
4. Explore **hands-on** activities that relate to those concepts

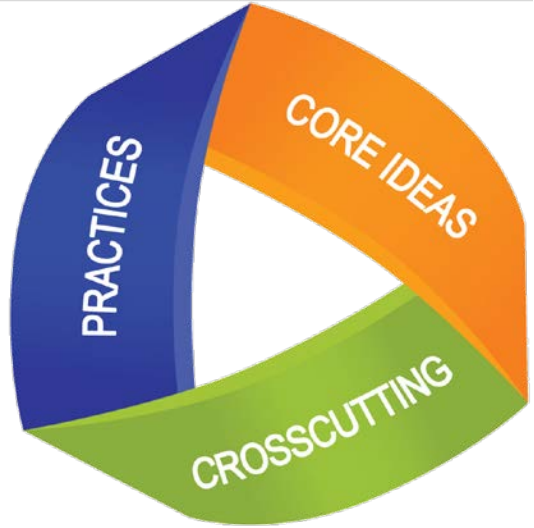
Designing Hands-On Activities

- Educapoles http://www.educapoles.org
- PolarTREC https://www.polartrec.com/resources
- AAD's Classroom Antarctica http://classroom.antarctica.gov.au/
- LDEO http://www.ldeo.columbia.edu/edu/polareducation/
- OHU Beyond Penguins & Polar Bears http://beyondpenguins.ehe.osu.edu
- CReSIS Education https://cms.cresis.ku.edu/content/education/k-12
- howtosmile https://www.howtosmile.org/
- Pinterest
- Google

One investigation or several bite-sized activity stations?

Next Generation Science Standards

- Phenomenon
- Question
- Investigation
- Big-Picture Connection
- New Questions



http://www.nextgenscience.org/

NGSS Example: Middle School Glaciology

Earth Science: role of water & cycles in Earth's surface processes; cycles in Earth systems; **Physical Science**: forces & motion; interaction of matter

Phenomenon/ Question

We know glaciers are moving ice fields.
Do they all move the same way?

Investigation

Modeling with "Glacier Goo"
to examine the effects of basal friction, channel friction, gravity, and drag on the nature and rate of glacier movement

Big Picture Connections

Different forces have different effects

Share your story

--

Bring unique supporting materials: images, videos, maps, specimens, equipment

--

Draw real-world connections through your research

Source: LDEO IcePods Bergy Bits http://www.ldeo.columbia.edu/edu/polareducation/

Gather Activity Supplies *– see supplies sheet for Bergy Bits activities*

1) Mound goo and toothpick is inserted perpendicular to the glacier pointing straight up.

2) As goo begins to flow watch what happens to the top of the toothpick.

3) As goo continues to flow watch what happens to the toothpick.

Glacier Ice Flow Activity:

Students mound their glacier goo into a ball and insert a toothpick into the center and observe the flow of the glacier goo in relation to the toothpick.

Describe your observations:

1) What happened to the toothpick?
2) What part of the glacier is flowing the most quickly?
3) Explain why you answered this way.
4) Identify where there is 'friction' in this 'glacial ice flow' activity.
5) How do you think this activity relates to a real glacier moving in the polar-regions?

IcePod: www.ldeo.columbia.edu/icepod More Activities: www.ldeo.columbia.edu/polareducation

Source: LDEO IcePods Bergy Bits http://www.ldeo.columbia.edu/edu/polareducation/

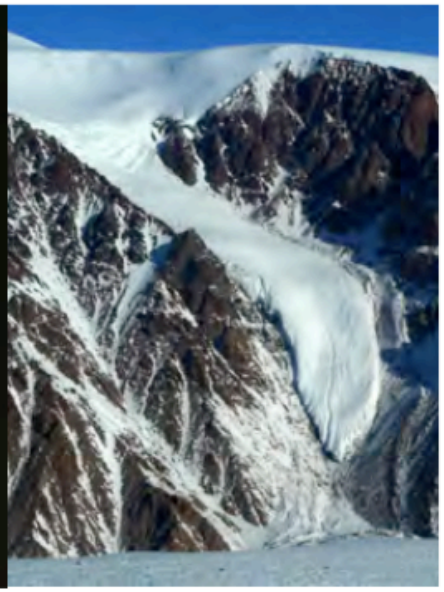
Named for small pieces of ice found in both the Arctic and Antarctic, 'bergy bits' in nature are small pieces of floating ice that break from an iceberg, ice shelf or glacier.

What is Friction? Friction is one surface or object rubbing against another. Friction always slows a moving object down.

Gather Activity Supplies – *see supplies sheet for Bergy Bits activities*

1) Position the glacier goo and draw a straight line across the face.

2) Observe: what happens to the straight line.



3) Real world photo of a glacier on Ellesmere Island, NW Canada.

Glacier Channel Ice Flow Activity:

Set up includes creating a channel for the glacier goo to flow through by taping rolled foil to the laminated grid on the matboard. Students mound their glacier goo to fill across the top region of the foil frame. Using a marker a straight line is sketched horizontally across the surface of the goo (frame 1). Let the glacier flow

Source: LDEO IcePods Bergy Bits http://www.ldeo.columbia.edu/edu/polareducation/

NGSS Example: 2nd Grade Biology

Life Science: Diversity of life in different habitats

Phenomenon/ Question

We know life exists on land and in the ocean.
Can life live anywhere else?

Investigation

Matching life forms to habitats

Big Picture Connections

Life can exist in extreme places

Share your story

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Bring unique supporting materials: images, videos, maps, specimens, equipment

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Draw real-world connections through your research

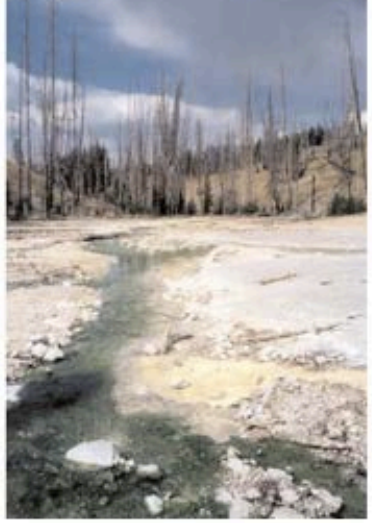

Image by Kathy Shehan
Courtesy of Micro*scope http://microscope.mbl.edu

Lemonade Spring in Yellowstone park has acidic (acid-like) water that can burn your skin.

Photograph by: Kristan Hutchison
National Science Foundation

McMurdo Dry Valleys in Antarctica have average temperatures of -20°C (-4°) and get less than 10 cm (4 inches) of rain each year.

Can Living Things Live Here?

Astrobiology: Science Learning Activities for Afterschool

Can Living Things Live Here?

Source: http://www.nasa.gov/pdf/145916main_Astrobiology.Guide.pdf#page=22

NGSS Example: High School Glaciology

Earth Science: Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems

Phenomenon/ Question	**How do we know climate change is anthropogenic?**
Investigation	**Digging into real ice core data to look at climate history**
Big Picture Connections	**Scientific, environmental, societal connections**

Share your story

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Share your methods

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Share your data

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Bring unique supporting materials: images, videos, maps, specimens, equipment

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Connect their activity to your actual research

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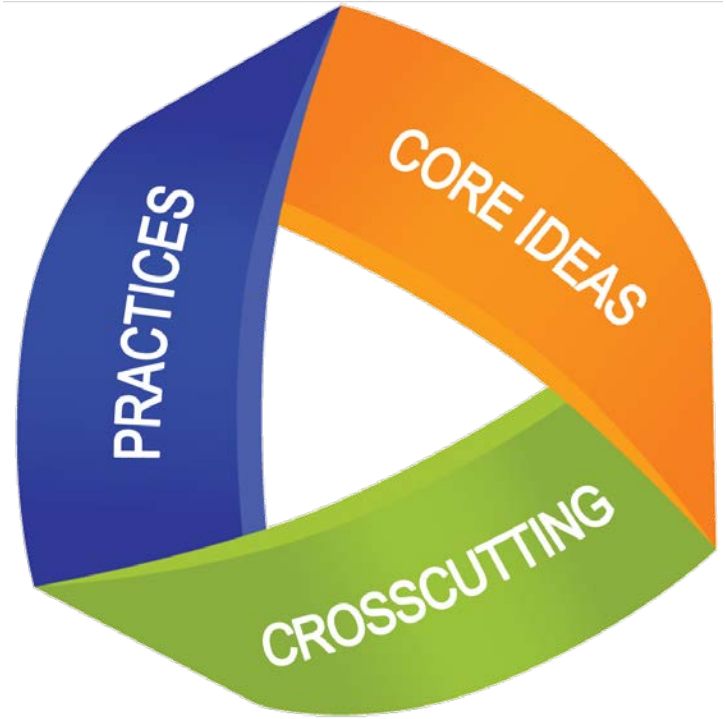
College / career advice

Next Generation Science Standards



http://www.nextgenscience.org/three-dimensions

Communicating Science in Schools

- Connect to your audience
  - Relatable real-world connections
  - Share your story & excitement
- Be adaptable: every school, grade, and student is different
  - Ask the teacher
  - Assess for learning
  - Use age-appropriate vocab, concepts, and metaphors
- Have a materials management strategy
- Work in a team (if you can)
- Encourage participation
  - Keep it interactive
  - Say, write, show
  - Diversify student selection (3 second rule)
- Have fun!

Thank You!

- Next Generation Science Standards: www.nextgenscience.org
- National Science Teachers Association NGSS: http://ngss.nsta.org
- Community Resources for Science: www.crscience.org

  Teach@CRScience.org