College and Career Ready Science Teaching Sampler

Fall 2014 NCTN Webinar Series on Science
Greetings from the NCTN!

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Our presenters

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Today’s webinar agenda

- ABE/ASE/Transition Science Videos
  - David

- Statistics for Action
  - Meghan

- LINCS Science Resources
  - Cynthia

- Questions and Comments

- Do you have a favorite resource?
Getting started

• What about you?

• What do you find is your biggest concern related to science teaching/learning resources and lessons?
Take it away, David
Science Videos

David J. Rosen
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ABE/ASE/Transition Science Videos

• ABE/ASE science teachers have created a list of science videos suitable for ABE/ASE and transition to college students.
• It is organized by:
  • 22 science video collection sites, and by
  • Science topics: animals, astronomy, botany (plants), chemistry, earth science, human body, health and disease, microscopic view of the world, nature, nutrition, physics, science history, and zoology.
• [https://docs.google.com/document/d/19F-_A7T-HcwwCCctxDoGFN0fyrryfKE1I_jG6-sLt1g/edit#](https://docs.google.com/document/d/19F-_A7T-HcwwCCctxDoGFN0fyrryfKE1I_jG6-sLt1g/edit#)
Video Reviews

- There is a 20-page document with ten peer-reviewed videos from this list
TV411 Science Series, What’s Cooking?

How Simple Ideas Lead to Scientific Discoveries, TED Ed Lessons Worth Sharing
Deep Ocean Mysteries and Wonders, part of the TED-Ed Lessons Worth Sharing Series

https://www.youtube.com/watch?v=Uqly8ERIlkHM
Heat, part of TV411 Science Series, What’s Cooking?

Photosynthesis, part of TV411 Science Series, What’s Cooking?

How should you use videos to teach science?
It makes a difference how you use science videos

• Just showing a video may not result in learning. Students may feel like they are learning and become more confident in their answers, but tests reveal they haven’t learned anything. Why?

• “Students have existing ideas about scientific phenomena before viewing a video. If the video presents scientific concepts in a clear, well illustrated way, students believe they are learning but they do not engage with the media on a deep enough level to realize that what was is presented differs from their prior knowledge”
It makes a difference how you use science videos

• Presenting students’ common misconceptions alongside the scientific concepts in a video has been shown to increase learning by increasing the amount of mental effort students expend while watching it.
Agenda

• What is Statistics for Action?
• How can HSE/ABE instructors use the materials and resources on the SfA website?
• How have instructors turned SfA activities into lessons for their classes?
Statistics for Action
In the Classroom

SfA situates opportunities for practicing math, science and reading skills in a dramatic community context: one where people’s health, homes and children’s well-being are on the line!

SfA helps students:

• **Understand** terms, units, and ideas in environmental data
• **Identify** newsworthy data
• **Communicate** facts and **ask** the right questions
SfA and Science
Education Standards

• Reading and analyzing data, making inferences and hypotheses. Analyzing and evaluating reasoning & evidence

• Symbols, terms, units and conversion

• Data presented in diverse ways, graphs, charts, tables, etc.
The legal limit for dioxin in drinking water is 0.00003 µg/L. That’s the same as 1 gram of dioxin added to 8.8 billion gallons of water.

A) 1 gram of dioxin is enough to poison the amount of water one American would use in 15,000 years.
B) 1 gram of dioxin is enough to poison the water that 15,000 Americans – the number of students who attend John Jay College – use in one year.
C) 1 gram of dioxin is enough to make 33 billion liters of soda unsafe to drink.
D) 1 gram of dioxin would poison over 13,000 Olympic-sized swimming pools’ worth of water.
E) It’s like one dime poisoning the entire U.S. Federal Budget.

What statement is most powerful in your opinion? Explain your opinion.
SfA offers... (sfa.terc.edu)

• Now we’ll take a tour of the SfA website, looking at the following resources:
  – Sample lesson plans by teachers using SfA activities
  – Guides for people new to environmental statistics
  – Activities
Activity Overview
Participants read a data set, and use provided strategies to find the most striking facts in the data. Then they practice expressing those facts in different ways to see which seems most newsworthy.

When to Use It
When a group needs practice reading data, finding a notable or newsworthy fact in the data, and putting that fact into words.

Suggested companion activities:
- Use after the group is comfortable reading data tables. If not, see Making Sense of the Data
- Follow with Communicating with Numbers.

Steps

Skill: Build fluency using different words to express relationships between numbers.
Time: 15-25 minutes
Preparation
Choose which data set you'll cover:
- Environmental Test Results
- Public Health Data
- Solid Waste
- Pesticides on Food

Read the Strategies for Reading, and Facilitator Resource for that data set
Practice writing a few statements yourself

Materials
Steps

1. **Launch the activity:** Reporters will often include one or two facts or statistics in their stories. They look for certain kinds of numbers: biggest, smallest, most typical, unusual, alarming. Our job is to give them the kinds of numbers they can use, without distorting or exaggerating. This will give us some practice doing that. (Hand out the Data Set and Strategies for Reading... If the group needs coaching, work out an example or two together.)

2. **In pairs or small groups:** Follow the strategies to find striking facts in the data. Try saying those facts in different ways, and choose the one that makes the strongest statement. (Optional: Assign each group a different kind of striking fact to find.)

3. **Debrief:**
   - How did this go? Was it hard or easy?
   - Were there ways of saying the data that were always your favorite (like percents, or _ in 10)? Or did it change for different numbers?

For the Facilitator

Pesticides on Food is the simplest data set. It’s best suited for a group who won’t need to read their own complex data, but who want to develop key skills. The other data sets have more challenging aspects: unfamiliar units, raw data, many options, etc.

If you want to use your own data, choose which Strategies for Reading... handout is the best fit. Format your data sets so they’re easy to hand out. If there are many pages, divide up the

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Materials

- Facilitator Resource (1 per facilitator)
- Data Set and Strategies for Reading... (1 per participant)
- Pens or pencils and scrap paper (1 per participant)
- Calculators (a few for the group to share)
Worth Noting

People get easily confused between “percent of” and “percent more/less than.” A drawing can help, like the ones shown here on the right.

Smart Moves

- Play with different ways to say it
- Use friendly numbers
Smart Moves

Do you worry that participants will tune out if you use tables and charts with lots of numbers?
No need to skip over the math and no need to do all the heavy lifting yourself!
Use the Smart Moves described below to engage participants. They will remember more
if they are actively involved in making sense of the information. Empower them!

Slow Down
Pause. Really. Before moving past a slide with numbers, invite participants
to note one or two observations
and one or two questions.

I can tell you what I see.
Let first, take a look...
What do you notice?
What questions do you have?

Connect ideas to what people already know
Use analogies to help volunteers to
connect the information to their own situations; comparing state reps. types
of emissions; or how to adapt a media strategy to a community of their size.

So, comparing our water-use
to state water standards works
just like comparing soil tests
to state soil standards!

Talk it out
Encourage participants to talk out
their observations and questions
with a partner. Give people who
don't understand a chance to
puzzle it out together.

Show numerical relationships in
more than one way
Use friendly numbers, convert units
and provide analogies, like
"1 part per million is like a drop
of ink in a large kitchen sink."

Appeal to the senses
Bring in some props to pass around.
Will you mention liters or kilograms
or cubic meters? Give people a chance
to hold a kilogram, or to stand next to
a cubic meter.

Encourage verification
Think about how you check your-
self. Recommend strategies such as
checking online resources, consulting
experts, and double-checking figures
with a calculator.
Sfa.terc.edu -> Using SfA -> For Educators
In a Plastic World
Facilitator Instructions contributed by Meghan McNamara

Reflection
I taught this lesson to my adult literacy class, which is a pre-GED level class. We had done some science previously, cell biology and health and medicine. This was our first time looking at a technical document.

Students were very excited generating the list of plastics we use in our daily life and had creative answers (hard hats, the watch I was wearing). Before we were finished they made observations like, “We live in a plastic world!” One student had heard of BPA and knew it was something you should look out for. (“Look for labels that say BPA-free.”)

Students connected with The Change Agent article. Their reactions to the piece were “scared” and “I didn’t know—what are we doing to ourselves?” The fact about BPA leaching in heated plastics stood out to many of them.

I was very impressed with students’ perseverance with the technical document. All students were able to come up with at least one question or observation. Many came up with a handful.

The most comments/questions were on the posters for “Health Risks” and “Action Steps.” (See photos below). We talked about how we could find definitions for the words we didn’t know, and also how to look up answers to the other questions we had. Their comments/questions around action steps generated rich discussion about government and corporate responsibility and monetary motivation. Students wanted to know how come more people didn’t know about BPA and how people who were illiterate were supposed to be able to find out about it. (Hire translators to talk to people in non-technical language, was one suggestion).

Students began the writing assignment in class, but many finished it for homework. It gave them a chance to try to share what they learned in class, putting it into their own words. Another writing prompt could have been to write a letter to an elected official with suggestions for educating people about BPA in plastic. See below for excerpts from student writing.

Activity Overview
1. Brainstorm (20 min)
   • Start with a brainstorm of all the plastics that we use in our daily life.
     > Students brainstorm on their own, then share with full group
A First Look at Technical Documents
Facilitator Instructions

Overview

Participants examine selections from a technical document and become familiar with typical sections. They record their observations and questions on sticky notes, and group those notes by category. Then they discuss next steps needed to identify information in the document that will help their campaign.

When to Use It

When a community has a technical document that seems impenetrable; they don’t know where to begin.

If you are leading this workshop at a conference where there is no particular technical document, you can find sample data sets in the Data Sources section at sfa.terc.edu.

Depending on the group’s questions, follow this workshop with other activities from Making Sense of the Data, Drawing Your Own Conclusions, and Pieces of the Risk Puzzle.

Skills

- Problem-solving through collaboration
- Identifying key information needed, and strategizing about how to find it

Notes for Facilitator

This workshop does not offer strategic advice about how to proceed with a campaign after reading a technical document, or about whether and how to challenge the findings in the document. Understanding your document is an important first step, but your campaign may be strengthened by calls for additional research, other sources of information, or expert testimony.

Time: 60 Minutes

Preparation

Choose which kind of technical document you have. Review the appropriate page of Strategies for Reading...

- Environmental Testing Results Reports
- Environmental Impact Statements
- Permit Documents

Using Strategies for Reading... select 1-2 pages from each “typical section” of your document. If possible, enlarge each of the selected pages on a photocopier.

Post one large blank sheet labeled “Other Questions or Observations.”

Cut apart Participant Instructions slips (p. 3). Tape them on each posted page.

Using Strategies for Reading... prepare blank poster-paper sheets with the Categories of Questions & Observations that match your technical document:

- Definitions and Properties
- The Process
- Results (or Predictions)
- Health Risks
- Action Needed

Materials

Enlarged selected pages from the technical document (posted on the wall or tables of the meeting room, leave plenty of space between them)

Participant instructions slips from p. 3 (one per posted page)
In a Plastic World
Facilitator Instructions contributed by Meghan McNamara

Student Work Samples
Below are excerpts of students writing from the last portion of the lesson, “Wrap up: In Writing.”

“A family member is having a baby. I will try as much as possible to tell her to be very careful whenever she is buying plastic supplies, especially baby bottles and the kind of food she is going to get for the baby.

“I will explain the little research I have done about BPA (Bisphenol A), how we have been exposed to this chemical...”

“Since we all have been already exposed to this Bisphenol A, I will tell her it’s in her breast milk, but not to be scared but to let her know it’s in our systems by being exposed. Also advise her not to buy plastic which the label doesn’t say BPA free, not to put any plastic into microwaves or boiling baby bottles, which as any African mothers we are fond of doing that. Also not to buy baby formula in the can.”

“I would tell an expecting mother to be about preventing BPA by asking if she has heard about it, once she says no and asks what is it? I will tell her it is a chemical that is in plastic bottles like water bottles and certain baby bottles and liquid formula. The best thing that we can start doing is reading instructions when shopping for baby items. Check for BPA free bottles, eating healthy instead of canned foods or using microwave, eat fruits, cook. Don’t microwave your baby’s milk, and if you’re pumping your breast milk out in a bottle best thing to do is breastfeed the baby so that the mom’s breast milk won’t be exposed to BPA. If not breastfeeding, instead of the liquid formula get the powder formula. Also can change the plastic bottles to glass bottles.”

“By protecting your baby from this toxins, it will be the safest way for you to avoid exposure to your infant. If you purchase any plastic make sure that it state BPA free. BPA free products are more expensive than regular plastic but it’s worth paying a little more for your infant’s safety. The reason why I’m sharing this with you because...”
Reflection

I taught this lesson to my adult literacy class, a pre-GED level class of around 25 students. It followed a lesson we had done a few classes earlier which focused on BPA in plastic and understanding technical documents.

Most students grasped the concept of exposure quickly and were able to give several examples of how we are exposed to BPA, such as drinking water from water bottles made with BPA, heating food in plastic that contains BPA, eating canned food, and babies drinking contaminated breast milk. (If you did not do the previous lesson on BPA in plastic you could use a more commonly known toxin, such as mercury or asbestos, as an example.)

After reading the handout about the park by the paint factory some students immediately knew what to do and starting scribbling equations on the side of their handout without my prompting them. However, a good number of students seemed to need a bit more direction, so I thought doing one problem together would be helpful.

I also found it particularly beneficial to have students put their work on the board for the remaining three problems. We took our time with each one, having the volunteer explain their reasoning and allowing other students to agree, disagree, or ask questions. We had to check that all the answers were given in the same units, e.g., converting minutes to hours.

For one of the problems, a student in the audience had used a different approach. We put her work on the board as well and compared the two answers, which were slightly different. This was for “Ellen”.

- **Approach 1:**
  - 3 months × 30 days = 90 days
  - 90 days/2 = 45 days
  - 2 hrs × 45 days = 90 hours

- **Approach 2:**
  - 12 weeks × 7 days = 84 days
  - 84 days/2 = 42 days
  - 42 days × 2 hrs = 84 hours

After both approaches were on the board I asked the rest of the class which approach they had used. Most students had used the second
Activity Overview
Participants rate several everyday activities that pose various levels of risk of exposure to contamination. They check their ratings against that of a public health professional.

When to Use It
When the community faces a toxic threat and the group needs more familiarity with the contaminants of concern and the concept of risk stemming from exposure, and/or when reviewing or preparing input on a risk assessment.

Suggested companion activities
- Precede with Pieces of the Risk Puzzle
- Use with Exposed, As Toxic As... ?, and The Change Agent: Staying Safe in a Toxic World pp. 22-23 (for benzo(a)pyrene)

Steps
1. Launch the activity: Contaminants only pose a risk when people are exposed—when there’s a point of contact between a person and the contaminant. For example, cigarettes cause cancer when people smoke them, but not when they are sitting on a shelf.
2. In small groups: Depending on the contaminant, the exposure pathway makes a big difference. Look at the different activities and put them in order from highest to lowest risk. Next, read the fact sheet for [contaminant]. Do you want to change your answers? Finally, read Check Your Answer for the contaminant to compare with a professional’s opinion.
3. Debrief:
   - What exposure pathways were new to you? What surprised you?
   - How does this relate to your own situation?

Worth Noting
Eating or drinking contaminated food or water is often (but not always) high risk. Risk for breathing, dermal contact, or skin contact can be lower. Contaminants like dust may be a problem indoors. Other contaminants may pose higher risk to children than adults.
Things to Consider
When Running an SfA Activity

• Build up context. The background story will help generate interest, after all they are all based on real life situations.

• Utilize SfA as a jumping off point or to synthesize and apply skills.

• The objective is to get students to ask the right questions when dealing with a real life situation that involves the health of their community and family.
SfA for Educators

Statistics for Action situates opportunities for practicing math, science, and reading skills in a dramatic community context: one where people’s health, homes, and children’s well-being are on the line.

SfA activities can be used at the beginning of a unit to spark interest, and/or at the end of a unit as synthesis activities. Many activities cut across multiple standards.

Sample lessons by teachers using SfA activities (your ideas welcome):
- Can't Stop Breathing contributed by Selene Gonzalez-Carillo
- Compare to Standards contributed by Michael Pitula
- In a Plastic World contributed by Meghan McNamara
- Toxic Exposure contributed by Meghan McNamara

Aligned to Standards

We’ve documented how SfA activities align with standards for math, science, and reading & social studies using three sets of standards:
- CER 2014 Assessment Targets
- ""
Get people involved in gathering data, seeing themselves in the data, before you shower people with data.
Frequency of pesticide residue on various fruits and vegetables.
Questions?
Reactions or Insights?

Statistics for Action
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Meghan McNamara
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Questions or Comments?
LINCS Resources

http://lincs.ed.gov
LINCS Learning Portal

• Engaging Adult Learners in Science

• Scientific Practices in Context

• Project-Based Science Instruction for Career Preparation
LINCS Communities of Practice

• Science
• Down the Drain
  • [http://www.ciese.org/curriculum/drainproj/overview/](http://www.ciese.org/curriculum/drainproj/overview/)

• Health Literacy:
  • How do people get Ebola?
LINCS Resource Collection

- Energy Literacy (for students, including adult learners)
- Climate Literacy: Essential Principles (primarily for teachers)
- Effective Prompts for Quick Writes in Science and Math (study)
A Non-LINCS Resource!

OER Commons: [https://www.oercommons.org/](https://www.oercommons.org/)
Science Textbooks
LESSON OBJECTIVES

The student will:

- give a brief history of how chemistry began.
- list some new materials produced by chemists.

INTRODUCTION

During medieval times, a group of people known as alchemists began looking for ways to transform common metals, such as lead, copper, and iron, into gold. Can you imagine how much money you would make if you could go to the store, buy some iron nails, and turn them into gold? You'd be rich in no time!

The Origin and Evolution of Chemistry

Alchemists experimented with many different kinds of chemicals, searching for what they termed the "philosopher's stone" – a legendary substance necessary for transforming common metals into gold (see Figure below). We now know that there is no such thing as a philosopher’s stone, nor is there any chemical reaction that creates gold from another metal. We know this because we now have a much better understanding of how the matter in our universe behaves. Nevertheless, those early alchemists kindled interest in chemical transformations and inspired the development of modern chemistry.

This painting shows an alchemist in search of the philosopher's stone.

Chemistry is the scientific study of matter and the changes that it undergoes. It's no coincidence that the word "chemistry" looks a lot like the word "alchemy." Early alchemists were commonly known as "chemists," and over time, people started referring
www.everyoneon.org/adulted
Questions/Comments?
Your Favorite Resource
Science at the NCTN Conference

Pre-conference: Wednesday
Nov 12 (9 AM to 12 noon)
• Using Science Content to Reach College and Career Readiness (And, Have Fun, Too!)
  by Cynthia

Session III: Thursday
November 13 (9-10:30 AM)
• Teaching Science using Online Videos & Flipped Learning
  by David

www.collegetransition.org
Thank you to our presenters

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