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Science Curriculum from the Grassroots

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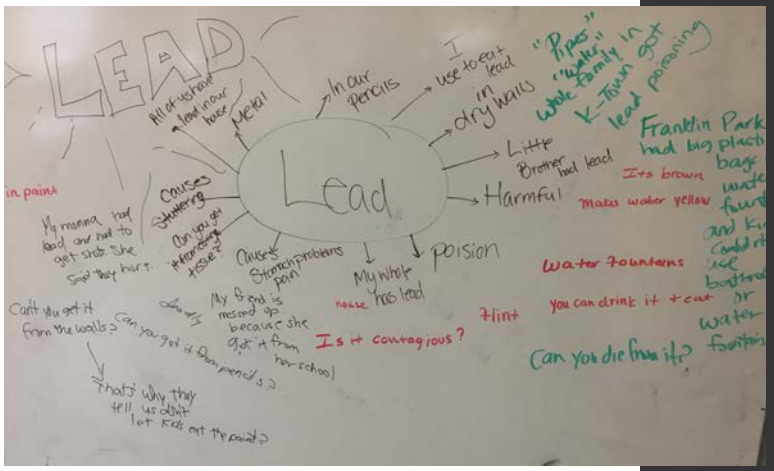
Who do we mean by grassroots?

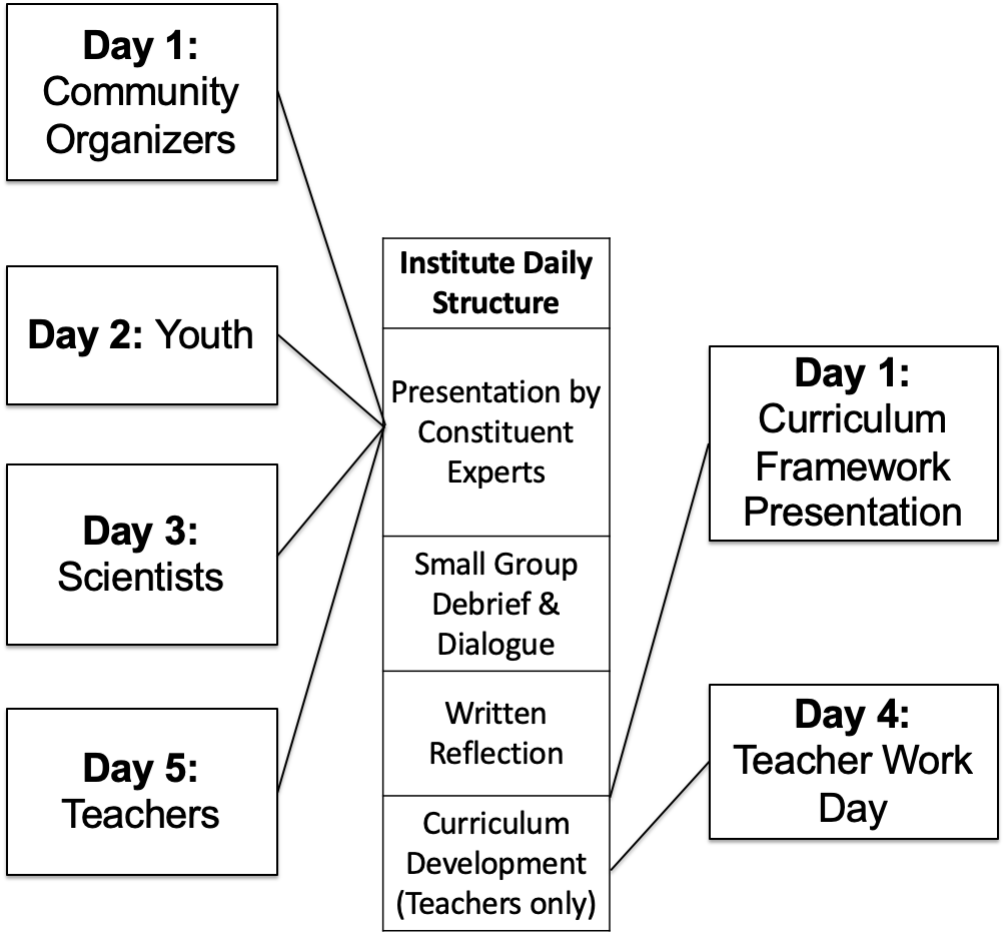
- Teachers
- Youth
- Parents
- Community Members
- Community Organizers
- Scientists



Our network…

- 7 high school science teachers
- 1 middle school science teacher
- a network of environmental justice organizations
- 3 scientists at 3 universities
- 1 university-based science educator
- high school students and recent graduates

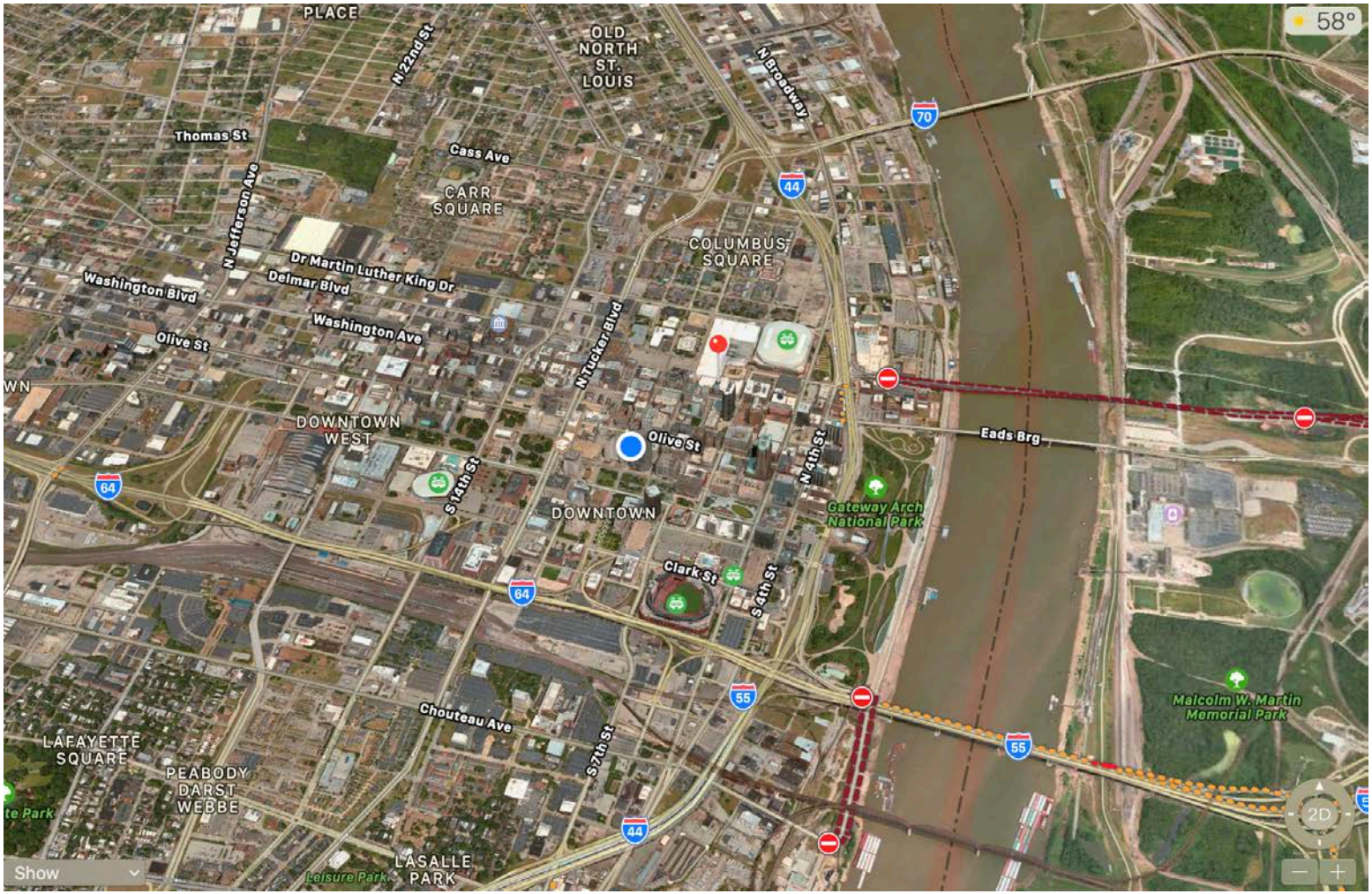
Planning Institute, Winter 2018



Teaching & Conducting YPS Projects, Spring 2018

Seven teachers led activities to define the social justice science issue.
Seven teachers led activities about understanding heavy metal contamination using chemistry concepts.
Four teachers led students in collecting soil samples.
Two teachers facilitated data analysis based on results of soil testing.
One teacher engaged students in dissemination or action beyond the classroom walls.

Create a Soil Sampling Plan



Developing a Soil Plan

Where....
How do you collect soil samples from around the community?
Which areas should you avoid and why?

How...
What quantity of soil do we need to collect for each sample?
What method and tools do we need to extract the soil?
How do we avoid contamination of soil samples?
How do we manage the soil collection process?

Then What...
What do you do with the results?
What if the results are good, bad or inconclusive?
Who do we tell and how?
What happens when the school year ends?

Poll Everywhere:

- In one word, what did you need to know (that you didn't know) to make an effective soil sampling plan?

In one word, what did you need to know (that you didn't know) to make an effective soil sampling plan? (Workshop Participant Responses)

NGSS alignment (we made it work…)

	Performance Expectations (Lead States, 2013)	Key NGSS Practices
Learning about heavy metals	HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	1. Asking questions and defining problems 2. Developing and using models 3. Planning and carrying out investigations 6. Constructing explanations and designing solutions
	HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.	
	HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.	
Learning to measure contamination	HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	4. Analyzing and interpreting data 5. Using mathematics and computational thinking 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information
	HS-ESS3-3. Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.	

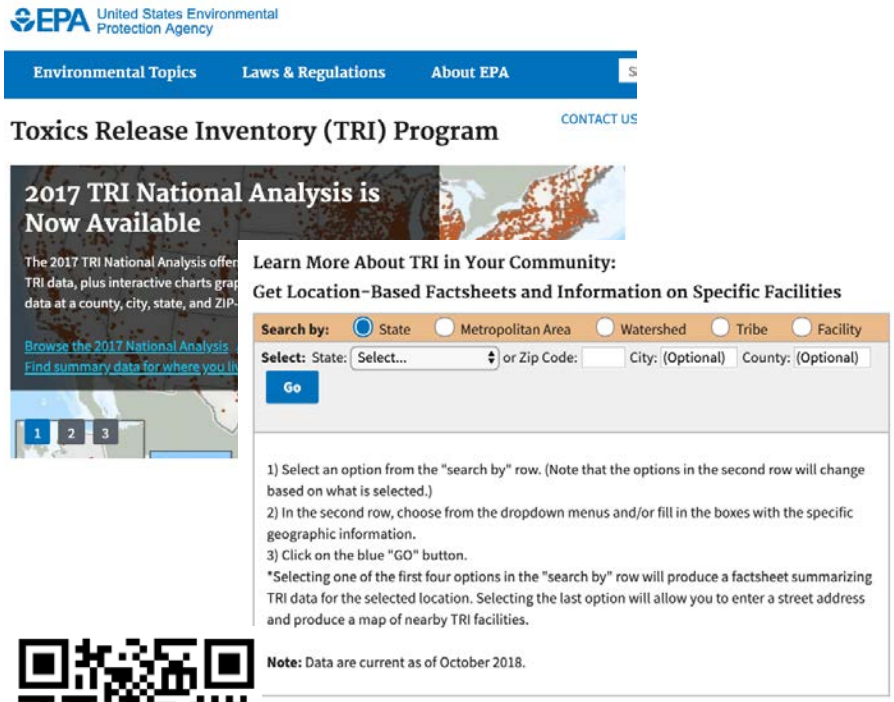
A Clear Consensus Emerged

- At our second institute, all partnership groups identified **the need for teachers and students to know more history** as a challenge for all of our YPS projects
- We planned Part B of Institute 2 based on this consensus and participation in Part B of Institute 2 led to a refined consensus about three themes in the requisite historical knowledge:

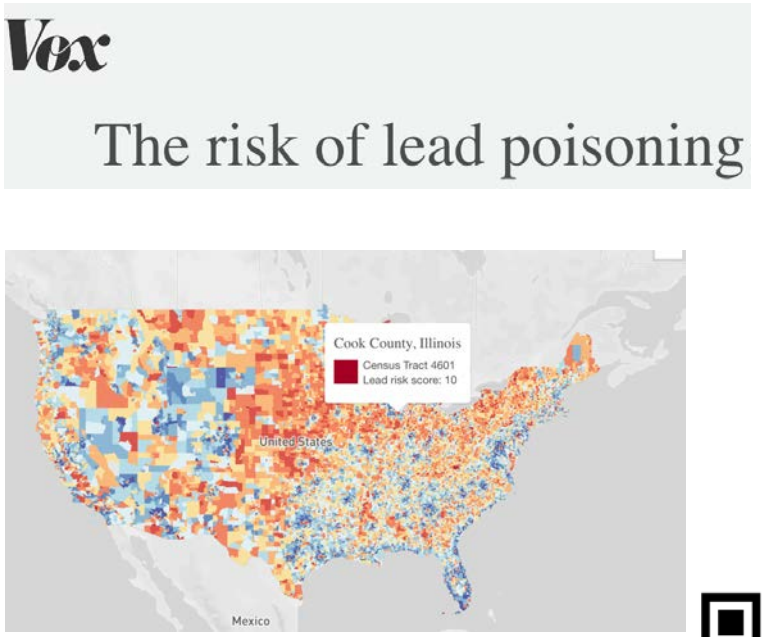
Historical Theme	Institute Learning Activity
History of the Neighborhood	History research time in library
History of Relationships Between Science & Industry	Four readings & discussion
History of Environmental Justice (EJ) Victories	Videoconference with EJ Activist & Community Asset Toxic Tour

Online mapping resources…with different pedagogical implications

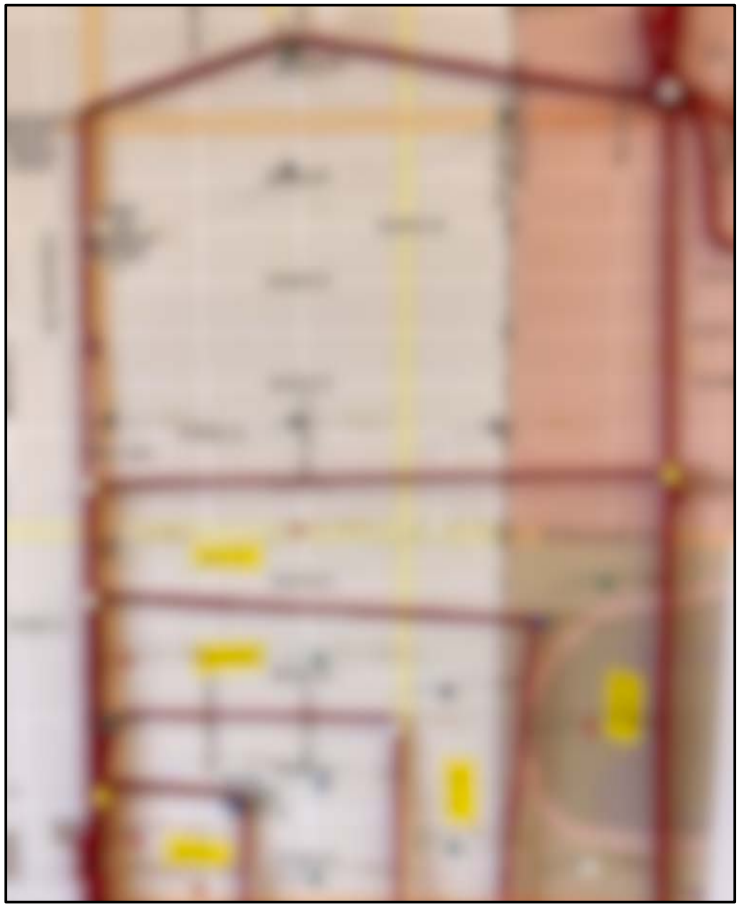
EPA Toxic Release Inventory



Vox Pb Exposure Model



Soil sampling map **created by high school students** based on information about molybdenum compound releases from the **EPA Toxic Release Inventory**.



Chemicals Released to Air

Chemical Name	TRI Chemical Id
COBALT COMPOUNDS	N096
COBALT COMPOUNDS	N096
MOLYBDENUM TRIOXIDE	001313275
MOLYBDENUM TRIOXIDE	001313275
NICKEL COMPOUNDS	N495
NICKEL COMPOUNDS	N495
NITRIC ACID	007697372
NITRIC ACID	007697372

Online mapping resources…with different pedagogical implications

EPA Toxic Release Inventory

- Current Data vs Historic Data
- Self-reported data from companies

SEPs

- Analyzing and interpreting data

Vox Pb Exposure Model

SEPs

- Construction of models
- Limitations of models
- Synthesis from complex models
- Construct an argument from a model

How is this affected by changing demographics, gentrification, etc. ?

Guided Vox Mapping Activity

- Create a **5-color scale** and show your prediction for the lead exposure risk you think each part of the city has.

Making Predictions

- Before we use a digital map tool with lead exposure risk predictions, let's make some predictions about our school and where we live. On a scale of 1-10, what would you predict is the risk of lead exposure on
- Complete the table below and compare your predictions above with the numbers given by Vox.
- Explain how close your predictions were to the ones given by the Vox map.

Location	Your Prediction	Vox's Prediction
Your block		
Our school		
Downtown Chicago		
North side		
South side		

Construct an Argument

According to Vox, in creating the mapping tool *"...researchers in Washington combed through the literature on lead poisoning to understand what factors best correlate with risk. They found that there were two [factors] — the age of the houses (which predicts the likelihood of lead paint) and poverty — that the literature consistently finds to be correlated with more kids coming into contact with lead."*

- A trend of greater lead exposure on the Eastern half of the United States could be an effect of which factor? Explain.
- Explain why large cities like Chicago and New York have high lead exposure risks compared to more rural areas of the country.

Develop and Use a Model

This map identifies the places where kids would experience the highest and lowest risks of lead poisoning. It does that by taking all 72,241 census tracts and assigning them a risk score between 1 and 10, based on how old the local houses are and the percentage of the population living in poverty... A high risk score doesn't mean kids living there are certain to come into contact with lead or to even to become poisoned. But it does show that, given what we know about lead exposure, kids in these areas are more at risk for such contact.

- How was the map developed?
- What are the strengths and limitations of the model?

Other resources

- Ghost Factories
  - http://usatoday30.usatoday.com/news/nation/smelting-lead-contamination/
- Energy Justice Map
  - http://www.energyjustice.net/map/
- Resources from the audience?

Questions?

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