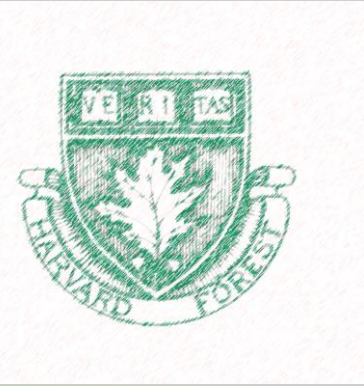
Teacher-Led Remote Learning Activities
Harvard Forest Schoolyard Ecology Spring Workshop
Session Four



Activity:

- **Description of Activity:**
  - **Part I – Synopsis of research**
  - **Part II - Ideas for putting nature of science understandings in the classroom**
- **Teacher/Author:** Maria Blewitt
- **School**: Austin Preparatory School
- **Level:** Grades 6-12
- **Schoolyard Project(s)**: Buds, Leaves and Global Warming

Teaching Objectives:

1. **To share research into teachers who use citizen science projects in their classroom.**
2. **To share some ideas about putting the nature of science in the classroom.**

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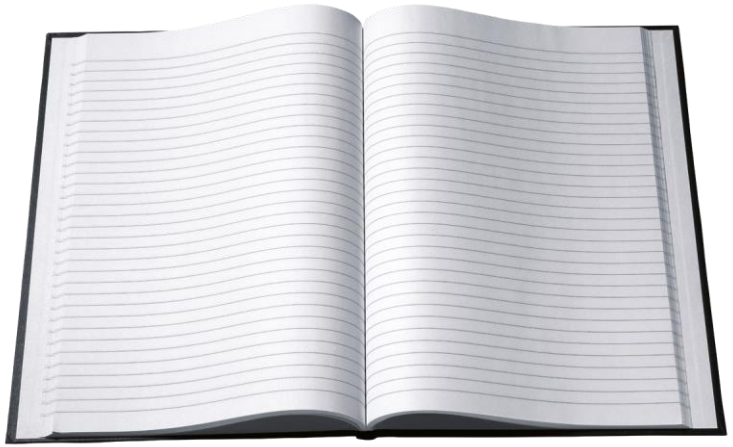
Part I: The far too long title of my dissertation:



HIGH SCHOOL SCIENCE TEACHERS' BELIEFS AND PRACTICES FOR SCIENTIFIC LITERACY DURING ENACTMENT OF A CITIZEN SCIENCE PROJECT

What's under the microscope?

- Who: 3 wonderful high school teachers who participate in the Harvard Forest Schoolyard projects
- What: scientific literacy
- How: qualitative research: case study with focused ethnographic techniques
- Why: too many science teachers across the US don't teach for scientific literacy (PISA results)

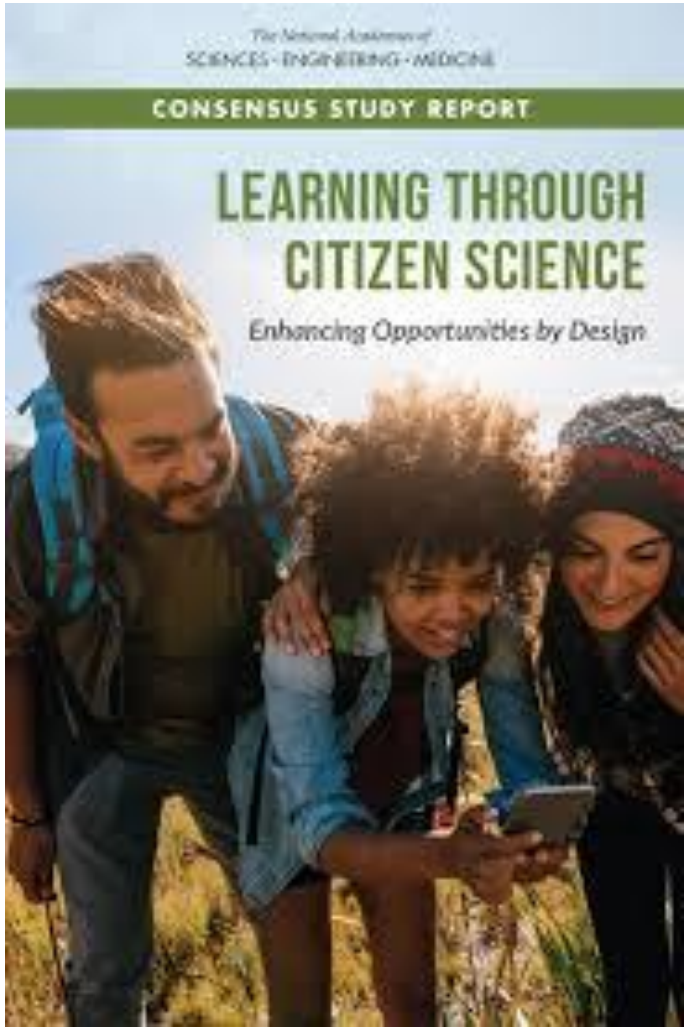
Why teachers and scientific literacy? Why not students?

2018 – National Academies Press

“CONCLUSION 5: There is evidence that citizen science projects can contribute to specific learning outcomes in particular contexts and for some learners” (p. 7).

And

“A minority of projects had statements of learning goals or learning claims around: learning science skills, learning about science and society and learning the scientific process” (p. 174).

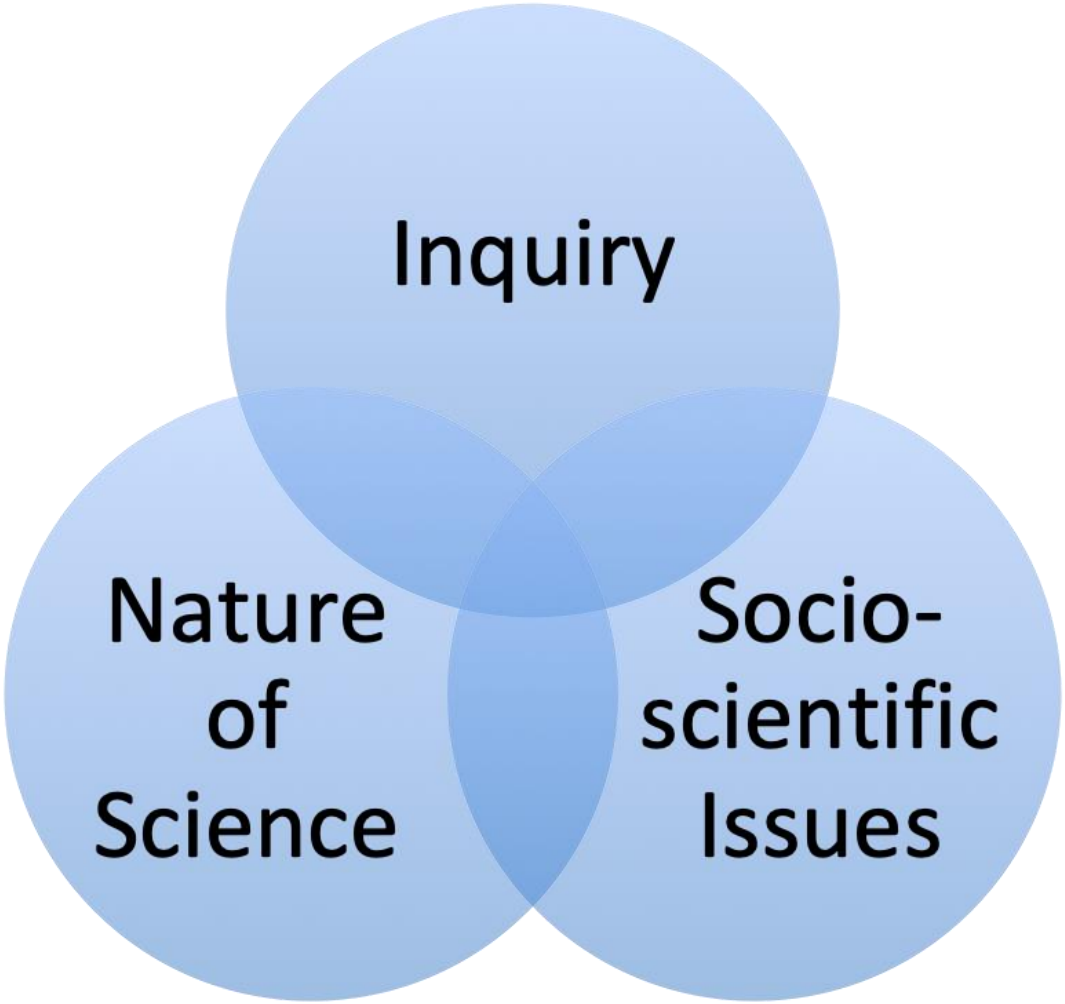


What is scientific literacy?

Inquiry: the scientific process as practiced by professional scientists

Socio-scientific issues: social/ethical issues that can be informed by science

Nature of Science: understanding how scientific knowledge develops



(Lederman, Antink, & Bartos, 2012)

Why is scientific literacy important?

1. To prepare our future scientists for their scientific careers
2. To create informed citizens who use science in their personal and societal decision-making

What is meant by beliefs and practices?

- Teacher agency – the intersection of what one believes is important for students to learn and what one is able to teach given the environment one teaches in

Why beliefs and practices for scientific literacy during a citizen science project?

- All three teachers involved freely chose by their own agency to include citizen science in their classrooms.
- This means that despite the constraints they may feel in their classroom teaching, they found the Harvard Forest Schoolyard projects were worth the time and commitment

What were the sources of data?

- Interviews
- Two classroom observations
- Teacher supplied artifacts, including but not limited to lesson plans, handouts, projects, rubrics, etc.
- Why not do a survey? Why a qualitative study?
  - To look at beliefs and practices
  - To do an in-depth look at teachers
  - To look at beliefs and practices

What were the key findings?

- 1. Teachers don’t just follow HF protocols and turn in data; they use HF as a springboard for other types of learning

What were the key findings?

- 2. A. Teachers bring inquiry – science as practiced by scientists - into their classrooms.
- 2.B. Not only does the HF project bring inquiry into the classrooms, but these teachers do other HF related inquiry projects.

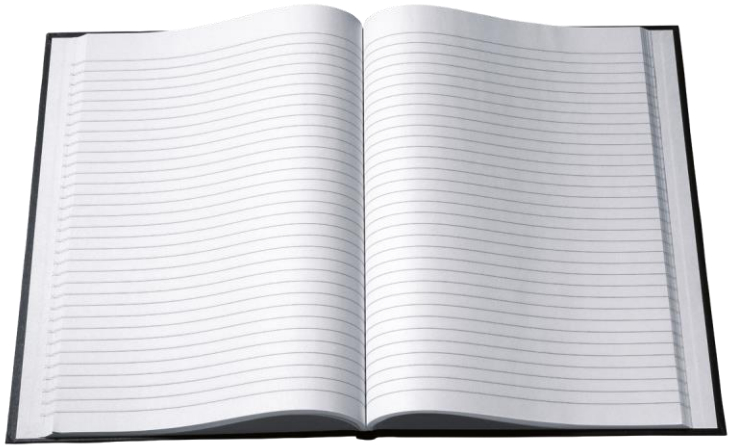
What were the key findings?

- 3. A. Teachers bring climate change into the classroom in a big way.
- 3.B. A small study by Sadler, Amirshokoohi, Kazempour and Allspaw (2006) showed that not all teachers embrace the idea of using socio-scientific issues in the classroom. Some teachers viewed science as objective and value-free and for this reason avoided socio-scientific issues in the classroom.

What were the key findings?

- 4. A. Teachers tended to understand the nature of science, but didn’t explicitly bring it into their classrooms with the HF projects.
- 4.B. A note: Research shows that explicit teaching of nature of science is important for understanding (Khishfe, R., & Abd-El-Khalick, F. 2002)

Part II: Going all the way with nature of science



- SOME IDEAS TO EXPLICITLY PUT NATURE OF SCIENCE IN YOUR CLASSROOM

Next Generation Science Standards Eight Nature of Science Understandings

- Scientific Investigations Use a Variety of Methods
- Scientific Knowledge is Based on Empirical Evidence
- Scientific Knowledge is Open to Revision in Light of New Evidence
- Science is a Human Endeavor
- Science Addresses Questions About the Natural and Material World
- Science is a Way of Knowing
- Scientific Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
- Scientific Knowledge Assumes an Order and Consistency in Natural Systems

Are you already doing a leaf drawing with your students?

Add an observation or inference component, and ask them how they know

Nature of Science Understanding:

Science is a way of knowing

- What do you observe about the leaf you drew?
  - Green, brown and white spots
  - Toothed
  - Oval, etc.
- What do you infer about the leaf?
  - Diseased – Bacteria? Virus? Fungus?
- How do you know the leaf is diseased?
- How would you go about finding out what disease the leaf has?

Are you already using a dichotomous key for tree identification?

Add a claim, evidence, reasoning component

Nature of Science Understanding:

Scientific Knowledge is Based on Empirical Evidence

And possibly

Scientific Knowledge is Open to Revision in Light of New Evidence

- Claim: My tree is a _____.
- Evidence: Pictures of salient tree parts.
- Reasoning: Based upon the key, I have determined that my tree is broad-leaved, alternate, toothed, etc.

A possible lesson plan on climate change that incorporates five of eight NOS understandings

Can you help me pilot this lesson?

Can you give me suggestions for improvement?

- Scientific Investigations Use a Variety of Methods
- Scientific Knowledge is Based on Empirical Evidence
- Scientific Knowledge is Open to Revision in Light of New Evidence
- Science is a Human Endeavor
- Science Addresses Questions About the Natural and Material World

With gratitude

- Three anonymous teachers who participated in this study
- Numerous teachers who participated in pilot studies before the final dissertation study
- Pamela Snow and all of the researchers and staff at HF
- My committee
- My family

What questions or comments do you have?

I'll be writing them down!

Did I Meet My Research Objectives?

- Part I: Through dialogue and observation of high school science teachers, I was able to add to the conversation about scientific literacy and citizen science projects.
- Part II: Through teachers piloting my nature of science/climate change lesson plan, I will improve the quality of the plan.

Implementation Notes:

- This lesson plan assumes students are familiar with the layers of the atmosphere, gases in the atmosphere, and the greenhouse effect.
- If you have high school students, you may want to omit the formative assessment about the mittens.
- I have not yet discussed the effects of human activity on the rise in temperature, but the purpose of this lesson is to set the stage to do just that.