Using online simulations to explain phenomena

Health in Our Hands: What controls my health?

Idit Adler & Renee Bayer
CREATE for STEM Institute
Michigan State University

Darlene McClendon
Flint Community Schools

Michigan Science Teacher Association (MSTA)
March 2018
CREATE for STEM Institute

• COLLABORATIVE research and innovation projects
• Partners in K-12 schools, higher education, research institutes, community organizations
• In Michigan, across the U.S., and worldwide
• Funding from MSU, NSF, NIH, Lucas Foundation, etc.

• Visit us at: create4stem.msu.edu
What will we do today?

1. Build understanding about the Next Generation of Science Standards (NGSS)

2. Explore what it means to use inquiry to experience phenomena through NGSS

3. Demonstrate the use of an online simulation as a means to perform inquiry in class

4. Discuss ways to incorporate a Driving Question Board into teaching
What’s new in the Framework and the Next Generation Science Standards (NGSS)?

“Figuring Out” vs. “Learning About”

1. Focus on explaining phenomena or designing solutions to problems
2. 3-Dimensional Learning (Disciplinary core ideas, scientific and engineering practices, crosscutting concepts)
3. Instruction builds towards performance expectations
4. Coherence: building and applying ideas across time
The Framework for K-12 Science Education – 3D learning

Knowing and doing **must work together** to form useable understanding that enables problem-solving, decisions making, explaining real-world phenomena, and integrating new idea

Integrating the three dimensions

✓ **Scientific and Engineering Practices (SEP)** – the major practices that scientists employ as they investigate and build models and theories about the world

✓ **Crosscutting concepts (CCC)** – concepts with application across all domains

✓ **Disciplinary core ideas (DCI)** – a set of core ideas in science
What is Inquiry?

Scientific inquiry refers to "the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work" (NRC, 2000, p. 23).

An inquiry question defines a relationship between two variables

Inquiry can provide a framework to engage students in authentic science by engaging in the various practices

The eight practices of science and engineering are:
1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematical and computational thinking
6. Engaging in argument from evidence
7. Obtaining, evaluating, and communicating information
We will investigate the effect of environmental factors on the health of sand rats using an on-line sand-rats simulation.

Try it out!
What can we manipulate in the simulation? (5 min)
What can we manipulate in the simulation?

- **Type of sand-rats:**
  - The Sand-rats’ health diabetes (diabetic vs. healthy)
  - The sand-rats’ risk of diabetes (high vs. low)
  - The sand-rats’ gender (male vs. female)

- **Type of food:**
  - Sugary vs. non-sugary food

- **Measurements:**
  - The sand rats’ weight (thin, heavy, obese)
  - Number of diabetic sand rats
Try it out!
How can we use this in class?
(10 min)
# Health in Our Hands: What controls my health?

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Driving Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson 1</td>
<td>Why does Monique have diabetes?</td>
</tr>
<tr>
<td>Lesson 2</td>
<td>How can we describe Monique’s diabetes?</td>
</tr>
<tr>
<td>Lesson 3</td>
<td>How does Monique’s family affect her diabetes?</td>
</tr>
<tr>
<td>Lesson 4</td>
<td>How does where Monique lives and what she does affect her health?</td>
</tr>
<tr>
<td>Lesson 5</td>
<td>How do Monique’s characteristics and environment affect her health?</td>
</tr>
<tr>
<td>Lesson 6</td>
<td>What can Monique do to make her environment healthier?</td>
</tr>
<tr>
<td>Lesson 7</td>
<td>How can we work together to make our environment healthier?</td>
</tr>
</tbody>
</table>

[Diagram showing the relationships between health factors and diabetes management]
Our framework for inquiry
structured → guided → open inquiry

• **Teacher-directed** to **student-directed**
• Continuous level of **openness** of inquiry based on the students' involvement, and the degree of the **teachers' intervention in instructing** the students:

The more responsibility the teacher takes, the more **guided** the inquiry; the more responsibility students assume for posing and responding to questions, designing investigations, and extracting and communicating their learning, the more **open** the inquiry.
Example of the sand-rats lesson from our curriculum
From a curriculum standpoint:
• The sand rats as means to engage students in scientific practices
• The importance of moving from structured → guided → open inquiry

From a teacher standpoint:
Using inquiry as a means to engage students in scientific practices
Thank you for joining us!

Idit Adler  adleridi@msu.edu
Renee Bayer  rbayer@msu.edu
CREATE for STEM Institute,
Michigan State University

Darlene McClendon  dmccclendon@flintschools.org
Flint Community Schools

Follow us on Instagram: health_in_our_hands

This project was supported by a Science Education Partnership Award (SEPA) from the National Institutes of Health, Office of the Director, under Award Number R25OD16534-1. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.