An Exploration of K-5 Science Units

Darcy McMahon and Phenomenal Science Team
Agenda

- What is Phenomenal Science?
- How was it developed?
- What is included?
- What are some results?
- How can you get involved?
What is Phenomenal Science?
What is Phenomenal Science?

SHORT ANSWER:

• A complete K-5 Science Curriculum to meet the NGSS / MSS
• Developed by teachers and educators for teachers
• 21 Units each centered on anchoring PHENOMENA
What is Phenomenal Science?

More Complete Answer:

• There are Many Parts!
  • Unit Introductions
  • Appendices
  • Assessments
  • Detailed lessons
  • Handouts
  • Links
What is Phenomenal Science?

More Complete Answer:

• There are Even MORE Parts!
  • Professional Development
  • Online Professional Development
  • Unit Revision Sessions
  • Facilitator Training Sessions
## WHAT DOES IT COVER?

<table>
<thead>
<tr>
<th>Grade</th>
<th>What Does It Cover?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KINDERGARTEN</strong></td>
<td></td>
</tr>
<tr>
<td><strong>1</strong></td>
<td><strong>2</strong></td>
</tr>
<tr>
<td>First Grade</td>
<td></td>
</tr>
<tr>
<td><strong>SECOND GRADE</strong></td>
<td></td>
</tr>
<tr>
<td><strong>2</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td><strong>THIRD GRADE</strong></td>
<td></td>
</tr>
<tr>
<td><strong>FOURTH GRADE</strong></td>
<td></td>
</tr>
<tr>
<td><strong>FIFTH GRADE</strong></td>
<td></td>
</tr>
</tbody>
</table>
How Was it Developed?
Research-Based Theories

- Constructivism
- Social Learning Theory
- Inquiry Instruction
- Multiple modalities
- HOTS and DOK
- Current Science Education Research

Visit [Phenomenal Science Blog](http://www.phenomenalscienceblog.com) for more info
Constructivism

Characteristics:
- Concrete experience [1]
- Testing in new situations [2]
- Observation and reflection [2]
- Forming abstract concepts [3]

Things to Remember:
- Start with a problem your Kids find relevant
- Use interdisciplinary exploration
- Develop HOT tasks
- Use primary sources

What it is:
- Based on background knowledge, connect to new knowledge
- Student centered
- Students learn how to learn

What it isn't:
- Teacher centered
- Skills in isolation

Collaboration
Social Learning Theory

Social presence
- Engagement with participants
- Supporting discourse

Cognitive presence
- Interaction re: goals/direction

Educational experience
- Setting climate
- Regulating learning
- Interaction re: goals/direction

Teaching presence
In an inquiry-based learning environment, the teacher’s job is not to provide knowledge, but to help students along their process of discovering knowledge.
Higher Order Thinking

- **Remembering**
  - Name, Find, List, Relate, State, Write
  - Locate, Describe, Tell

- **Understanding**
  - Understanding & Making Sense Out of Information
  - Interpret, Explain, Translate, Discuss, Outline

- **Applying**
  - Use Information in a New (But Similar) Situation
  - Analyze, Examine, Solve, Show, Construct, Use, Complete, Show, Clarify

- **Evaluating**
  - Critically Examine Information & Make Judgements
  - Judge, Assess, Choose, Justify, Decide

- **Creating**
  - Use Information to Create Something New
  - Invent, Design, Construct, Compare, Imagine
A Framework for K-12 Science Education

THREE Dimensions!

All at once!
Core Principles

- **Phenomena-Based Engagement:** In every instructional cycle, students encounter a puzzling event that really happens and are challenged to explain it. They develop their own explanation through intentional application of the Science and Engineering Practices, building understanding of core ideas, and consideration of the phenomena through the lens of a particular cross-cutting science concept.
  - **Evidence is the heart of the scientific enterprise.** Students generate evidence and analyze patterns in data that help to construct scientific explanations around key questions.
  - **Science Driven Integration of content areas** allows for a synergy that leads to greater understanding in all content areas. Students who read and write about science phenomena after engaging in hands-on investigation of the phenomena, have much greater understanding about both the phenomena and what they read or write about it.

- **Student Centered / Student Driven:** Instruction begins with the student’s ideas and understanding and follows the growth of the student throughout the instructional cycle.
  - It’s critical to **elicit prior knowledge** as a unit or lesson begins.
  - **Key questions** about **Real World Phenomena** should be student focused and drive student explorations and investigations.
  - **Assessment** of knowledge, skill, and reasoning should involve students throughout the learning process and be well aligned to the main objectives and activities of the unit.
Core Principles

● Students discover and develop concepts through inquiry
  o **Activity Before Concept** – Student inquiry-based explorations which give personal experience with phenomena and ideas should precede a presentation of science ideas.
  o **Concept Before Vocabulary** – Attaching science vocabulary to concepts developed by student investigations yields more success than beginning a unit or lesson with a list of science vocabulary.
  o **Application** of the ideas to explain phenomena and / or engineer solutions provides review, extends understanding, and reveals relevance of important ideas.
    ▪ Inquiry Model of Instruction

● Understanding is Constructed Socially through discourse and processing activities.
  o **Talk, argument and writing** are central to scientific practice and are among the most important activities that develop understanding.
  o Development of a healthy **Classroom Culture** by setting classroom norms and teaching students how to engage in productive discourse is vital to engaging students science discourse for deep science learning.
Understanding by Design

UbD: Stages of Backward Design

Stage 1. Identify desired results.
Guiding Questions:
- What are the established goals?
- What "big ideas" do we want students to come to understand?
- What essential questions will stimulate inquiry?
- What knowledge and skills need to be acquired given the understandings and related content standards? What focus questions will guide students to targeted knowledge and skills?

Stage 2. Determine acceptable evidence.
Guiding Questions:
- What is sufficient and telling evidence of understanding?
- Keeping the goals in mind, what performance tasks should anchor and focus the unit?
- What criteria will be used to assess the work?
- Will the assessment reveal and distinguish those who really understand versus those who only seem to understand?

3. Plan learning experiences and instruction.
Guiding Questions:
- What instructional strategies and learning activities are needed to achieve the results identified in Stage 1 and reflected in the assessment evidence specified in Stage 2?
The Request
Collaboration
Beginning with the End in Mind

Phenomenal Science Units are aligned to the appropriate grade-level Michigan Science Standards (and the NGSS) and intentionally focuses on all three dimensions of those standards including Disciplinary Core Ideas, Science and Engineering Practices, and the Cross-Cutting Concepts. The following chart portrays these interrelations. Also, all Phenomenal Science units include some integration of the reading and the writing strands of the Michigan English Language Arts Standards (CCSS-ELA) and the Mathematical Practices of the Michigan Mathematics Standards (CCSS – Mathematics). The Michigan Science Standards are a downloadable document, and Next Generation Science Standards are also available online. A graphic organizer has been developed which shows the topics, skills, concepts and phenomena of this unit.
How will science education change with the MSS?

**Science education will involve less:**

1. Learning of ideas disconnected from questions about phenomena
2. Teachers providing information to the whole class
3. Teachers posing questions with only one right answer
4. Students reading textbooks and answering questions at the end of each chapter
5. Worksheets
6. Oversimplification of activities for students who are perceived to be “less able” to do science and engineering

**Science education will involve more:**

1. Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned
2. Students conducting investigations, solving problems, and engaging in discussions with teacher guidance
3. Students discussing open-ended questions that focus on the strength of the evidence used to generate claims
4. Students reading multiple sources and developing summaries of information
5. Student writing of journals, reports, posters, and media presentations that offer explanations and arguments
6. Provision of supports so that all students can engage in sophisticated science and engineering practices
First Summer

- 24 K-5 Teachers
- 2 Coaches
- 1 Director
- 10 days

The Result: only 6 DRAFT Units

Piloted during 2015-16

Some more units sketched during school year
Second Summer

- 30 K-5 Teachers
- 6 Coaches
- 1 Director, 1 Manager
- 15 days

The Result: All 21 DRAFT Units
PROCESS FOR 2015-17

- FIELD TESTING WITH 425 TEACHERS
- GATHERING AND ANALYZING FEEDBACK
- REVISING AND EDITING OF UNITS
- DEVELOPING ONLINE / BLENDED PROFESSIONAL LEARNING RESOURCES
Revision Process

Gathering Feedback from Field testing
Analyzing Feedback from Field testing
Digging into Key Areas of Concern
One week working with all units with teacher leaders and coaches
One month intense focus on 1-2 units at each grade level
(7 units revised each month July - Sept)
<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>School/Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Management Team</td>
<td>Darcy McMahon</td>
<td>Phenomenal Science Project Director</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Science Mathematics Technology Center</td>
</tr>
<tr>
<td></td>
<td>Matt Samocki</td>
<td>Phenomenal Science Project Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Science Mathematics Technology Center</td>
</tr>
<tr>
<td>Phenomenal Science Coaches</td>
<td>Jennifer VanDaele</td>
<td>Kindergarten Coach, Science Editor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lenawee ISD</td>
</tr>
<tr>
<td></td>
<td>Erin Davis</td>
<td>First Grade Coach</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Birch Run Public Schools</td>
</tr>
<tr>
<td></td>
<td>Jennel Martin-Powell</td>
<td>Second Grade Coach</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Science Mathematics Technology Center</td>
</tr>
<tr>
<td></td>
<td>Bo Winkler</td>
<td>Third Grade Coach</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wink's PLACE Consulting, LLC</td>
</tr>
<tr>
<td></td>
<td>Joe Austin</td>
<td>Fourth Grade Coach</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Waterford Schools</td>
</tr>
<tr>
<td></td>
<td>Jessica Ashley</td>
<td>Fifth Grade Coach</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oakland Schools</td>
</tr>
<tr>
<td></td>
<td>Elizabeth Christiansen</td>
<td>K-5 Coach</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Science Mathematics Technology Center</td>
</tr>
<tr>
<td></td>
<td>Theresa Schroeder</td>
<td>K-5 Coach</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bullock Creek School District</td>
</tr>
<tr>
<td></td>
<td>Sheila Bartie</td>
<td>Editor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GiveVoice</td>
</tr>
<tr>
<td></td>
<td>Rochelle Rubin</td>
<td>3-5 Reviser</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oakland Schools</td>
</tr>
<tr>
<td></td>
<td>Megan Coonan</td>
<td>K-5 District Coordinator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bangor Township Schools</td>
</tr>
</tbody>
</table>
Kindergarten Authors
Cori Bierlein
Bangor Township Schools

Patricia Clancy
Midland Public Schools

Olivia Flores
Perry Public Schools

Lisa Warren
Trinity Lutheran School

First Grade Authors
Alice Ernst
Perry Public Schools

Sarah Fox
Fulton Schools

Sarah Nevins
Fulton Schools

Lori Taglauer
Bangor Township Schools

Second Grade Authors
Julia Adler
Troy School District

Melissa Batts
Troy School District

Kim Fluder
Saginaw Township Community Schools

Jennifer Knoll
Bangor Township Schools

Julie Leach
Frankenmuth School District

Tosha Miller
Frankenmuth School District

Mary Kate O’Meara
Grosse Pointe Public Schools

Tracey Pitchford
Farrwell Area Schools

Clayton Spencer
Farrwell Area Schools

Third Grade Authors
Jodi Bilacic
Au Gres Schools

Nikki Broadstone
Pinconning Area Schools

Ashly Ginderske
Saginaw Township Community Schools

Hollee Hart
Bullock Creek School District

Alexandria Hill
Bangor Township Schools

Jacob Kauffman
Arenac Eastern Schools

Arica Klopf
Saginaw Township Community Schools

Emily Ramsay
Pinconning Area Schools

Fourth Grade Authors
Mary Burgess
Roseville Community Schools

Sara Engelhardt
Bangor Township Schools

Holly Fouchia
Pinconning Area Schools

Deneal Johnson
Bullock Creek School District

Jeffrey Katt
Standish-Sterling Community Schools

Steven Markey
Midland Public Schools

Heather Norman
Jackson Public Schools

Lisa Rando
Jackson Public Schools

Fifth Grade Authors
Carrie Carncross
Farrwell Area Schools

Jodie Gould
Harrison Community Schools

Amy Klopf
Coleman Community Schools

Christy Macias
Saginaw Township Community Schools

Jennifer Meyers
Bangor Township Schools

Amy Mika
Bangor Township Schools

Sonja Pohlson
Godfrey-Lee Public Schools

Hazel Thomas
Saginaw Public Schools
<table>
<thead>
<tr>
<th>Allegan Public Schools</th>
<th>Gladwin Community Schools</th>
<th>Ottawa Area ISD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen Park Public Schools</td>
<td>Godfrey-Lee Public Schools</td>
<td>Perry Public Schools</td>
</tr>
<tr>
<td>Alma Public Schools</td>
<td>Grand Haven Area Public Schools</td>
<td>Pinconning Area Schools</td>
</tr>
<tr>
<td>Armada Area Schools</td>
<td>Grand Rapids Public Schools</td>
<td>Roseville Community Schools</td>
</tr>
<tr>
<td>Auburn Area Catholic School</td>
<td>Gratiot-Isabella RESD</td>
<td>Saginaw Chippewa Academy</td>
</tr>
<tr>
<td>Bangor Township Schools</td>
<td>Hamilton Community Schools</td>
<td>Saginaw Township Community Schools</td>
</tr>
<tr>
<td>Bay-Arenac ISD</td>
<td>Harrison Community Schools</td>
<td>Shepherd Public Schools</td>
</tr>
<tr>
<td>Berkley Schools</td>
<td>Hartland Consolidated Schools</td>
<td>St. Louis Public Schools</td>
</tr>
<tr>
<td>Birch Run Area Schools</td>
<td>Hudsonville Public Schools</td>
<td>Standish-Sterling Community School District</td>
</tr>
<tr>
<td>Breckenridge Community Schools</td>
<td>Jackson Public Schools</td>
<td>Thornapple Kellogg School District</td>
</tr>
<tr>
<td>Brighton Area Schools</td>
<td>Kent ISD</td>
<td>Utica Community Schools</td>
</tr>
<tr>
<td>Chippewa Valley Schools</td>
<td>Lake Shore Public Schools</td>
<td>Van Dyke Public Schools</td>
</tr>
<tr>
<td>Christian Schools International</td>
<td>Lakewood Public Schools</td>
<td>Vestaburg Community Schools</td>
</tr>
<tr>
<td>Clare-Gladwin RESD</td>
<td>L'Anse Creuse Public Schools</td>
<td>Warren Woods Public Schools</td>
</tr>
<tr>
<td>Comstock Park Public Schools</td>
<td>Lincoln Consolidated Schools</td>
<td>Washtenaw ISD</td>
</tr>
<tr>
<td>Crossroads Charter Academy</td>
<td>Macomb ISD</td>
<td>Waterford School District</td>
</tr>
<tr>
<td>Dexter Community Schools</td>
<td>Manchester Community Schools</td>
<td>Wyoming Public Schools</td>
</tr>
<tr>
<td>Essexville-Hampton Public Schools</td>
<td>Mt. Pleasant Public Schools</td>
<td></td>
</tr>
<tr>
<td>Farwell Area Schools</td>
<td>Oakland Schools</td>
<td></td>
</tr>
</tbody>
</table>
What is Included?
Included in PS

Included in the Units:

- Goals, Evidence of Learning, Learning Plan
- Resources, Handouts
- Assessments

Included in the Process /Project:

- Professional Development
- Online Professional Development
- Unit Revision Sessions
- Facilitator Training Sessions
## WHAT DOES IT COVER?

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.1: Star Light, Star Bright Space Systems</td>
<td>1.2: Feature Factor Structure, Function &amp; Info Processing</td>
<td>1.3: Oh, Say Can You See! Sound and Light Waves</td>
</tr>
<tr>
<td></td>
<td>3.1: Let's Move It Force &amp; Motion</td>
<td>3.2: Wild Wacky Weather Weather &amp; Climate</td>
<td>3.3: No Place Like Home Plants and Animals</td>
</tr>
<tr>
<td></td>
<td>4.1: Let it Rip! Energy</td>
<td>4.2: Built for Survival Plants &amp; Animals</td>
<td>4.3: Surf's Up Waves &amp; Info Transfer</td>
</tr>
<tr>
<td></td>
<td>5.1: Ch-ch-ch-Changes Matter &amp; Its Interactions</td>
<td>5.2: Round and Round It Goes Matter, Energy, and Ecosystems</td>
<td>5.3: Go with the Flow Earth Systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.4: To Infinity and Beyond Earth &amp; the Universe</td>
</tr>
</tbody>
</table>

### Kindergarten
- **K.1: Barriers Up! Force and Motion**
- **K.2: It’s Up to You to Make a Difference Earth and Environment**
- **K.3: Warm Up, Cool Down! Energy**

### First Grade
- **1.1: Star Light, Star Bright Space Systems**
- **1.2: Feature Factor Structure, Function & Info Processing**
- **1.3: Oh, Say Can You See! Sound and Light Waves**

### Second Grade
- **2.1: What Does It Matter? Matter**
- **2.2: Shifting Sands Earth Events & Diversity**
- **2.3: Bloom Where You’re Planted Plants**

### Third Grade
- **3.1: Let’s Move It Force & Motion**
- **3.2: Wild Wacky Weather Weather & Climate**
- **3.3: No Place Like Home Plants and Animals**
- **3.4: Stick Together Adaptations**

### Fourth Grade
- **4.1: Let it Rip! Energy**
- **4.2: Built for Survival Plants & Animals**
- **4.3: Surf’s Up Waves & Info Transfer**
- **4.4: Big Blue Marble Earth Systems**

### Fifth Grade
- **5.1: Ch-ch-ch-Changes Matter & Its Interactions**
- **5.2: Round and Round It Goes Matter, Energy, and Ecosystems**
- **5.3: Go with the Flow Earth Systems**
- **5.4: To Infinity and Beyond Earth & the Universe**
ALL 21 UNITS ON MVU WEBSITE

• HTTP://LOR.MIVU.ORG/PHENOMENAL-SCIENCE

• GRADE 2 UNIT 2 EXAMPLE:

• https://docs.google.com/document/d/1WKSvJz5i_dGnNA0GNPMke3Qn2mSj7ZlLx5A1kAy5QG8/edit?ts=57892b88
Unit K.1: Barriers Up

**Essential Question:** How do scientists investigate and describe how things move and what effects barriers have on objects in motion?

**Evidence of Learning**
Performance Task: Students will be able to create a barrier that changes the motion and speed of an object. Once the barrier is created, students will take turns presenting their model. Before the demonstration, they will explain how they intend their model to function and predict the outcome. Then, they will position their barrier at the end of the slide and release the object (e.g., a marble) down the slide. If the barrier does not function as intended, students may either choose to make an immediate adaptation to their model or students may choose to simply verbalize what change(s) should be made to the model.

**Instructional Cycle 1**
- **Phenomenon:** Students in motion on the playground
- **Focus Question:** What causes things to move?

**Instructional Cycle 2**
- **Phenomenon:** Story of a collision of a boy and teddy bear at bottom of slide
- **Focus Question:** How does the amount of force change how things move?

**Instructional Cycle 3**
- **Phenomenon:** Different types/speeds of objects
- **Focus Question:** How does the design of an object affect the speed and distance of that object?
Unit 5.1 Go with the Flow
Learning Plan Overview

Pre-Assessment Assessment of Student Conceptions

Direct students to work in pairs and create a concept map in their science notebooks using the following terms: Rain, Michigan waters, fish, shoreline. Monitor students as they work together. Look for arrows and words explaining the arrow connections. Ask for students to draw and explain their concept maps on the board for all classmates to see. Close this pre-assessment activity by asking the class what patterns they notice in the shared concept maps.

<table>
<thead>
<tr>
<th>Instructional Cycle</th>
<th>Focus Question</th>
<th>Anchoring Phenomenon</th>
<th>Vocabulary Introduced</th>
<th>Formative Assessment Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How can organisms, such as zebra mussels, affect the Great Lakes?</td>
<td>Zebra Mussels are making our waters clearer.</td>
<td>System, Subsystem, Interaction, Geosphere, Hydrosphere, Biosphere, Atmosphere, Ecosystem, Cause, Effect, Invasive Species/Aquatic Hitchhiker, Model</td>
<td>Notebooks Investigations Models</td>
</tr>
<tr>
<td>2</td>
<td>Why do water levels of the Great Lakes change over time?</td>
<td>What has caused the lake levels of Lake Michigan to change between 1986 and 2013?</td>
<td>Geosphere, Model, Groundwater, Glacier, Oceans, Lakes, Rivers</td>
<td>5.1.2.5 “Revise the air-water bag system model to explain the interaction between the hydrosphere and atmosphere.”</td>
</tr>
<tr>
<td>3</td>
<td>What are the causes and effects of the changing landscape of the Sleeping Bear Dunes?</td>
<td>The landscape of Michigan shorelines is changing.</td>
<td></td>
<td>Notebooks Investigations Models</td>
</tr>
</tbody>
</table>
### Inquiry Cycle

#### Stage | Activity / Lesson Title
--- | ---
**Engage** | Show students picture of [Burning Michigan Forest](#)

The DNR was called, but they actually already knew about it, because they started the forest fire! They claimed it would help the organisms that live there. How can this be true?

Ask students:
- Have you ever seen a forest fire or what the forest looks like right after a forest fire?
- What kinds of plants and animals might live in a Michigan forest?
- What do you think happens to all of the living organisms living in a forest when there is a fire?

**Explore** | Students will analyze photographs of a Michigan Forest region and identify evidence that will answer the question: “Can the environment support the needs of plants and animals that lived in the habitat before the fire?” Before viewing photographs, students will create a list of the what each selected living thing would need to survive and reproduce (establish a population) in the post fire habitat. For each photograph, students will use their observations to analyze how well the habitat would/is meeting organisms needs.

“What we wonder” guiding questions:

- Are all environmental changes bad for living organisms?
- What benefits are there from environmental change?

**Explore** | In small groups or with a partner students will research organisms typically found in Michigan Forests
Use Michigan DNR website as resource.
Include population data for a species before, during after a forest fire for a selected organism.
<table>
<thead>
<tr>
<th>Explain</th>
<th>Students will analyze collected data about selected organism. Students develop before and after pictures (model) to show the changes in the environment and how the animals / plants reacted. They will then make before and after pictures to show the changes that would help the animals now.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore</td>
<td>Students use an Internet resource describing sand dune succession to analyze the model provided and to identify the variables and rules for how components of the model interact within the example. They will develop a generic scientific model which they can apply to other types of changing habitats.</td>
</tr>
<tr>
<td>Explain</td>
<td>Students will create a before-during-after model of sand dune succession including organisms and provide evidence to support a claim about the typical changes and survival of organisms.</td>
</tr>
</tbody>
</table>
| Explore | Introduce Kirtland Warbler Phenomena and Dilemma  
[Data Table](#)  
[DNR Information](#)  
[BioKIDS Kirtland Warbler info](#)  
Questions to consider while exploring the information about the Kirtland’s Warbler:  
*What are some specific characteristics of the environment in which the Kirtland’s Warbler lives?*  
*How does the problem of no natural fires affect the Kirtland’s Warbler?*  
Data discussion, Kirtland’s Warbler study |
| Explain | Students develop before and after pictures/diagram/model to show the changes in the environment and how the animals / plants reacted. They will then create models/diagrams to indicate the changes that would help the animals now. |
| Elaborate | Students *Make a claim about the merit of a solution* (controlled burns every 20 years) *to a problem* (no natural fires) *caused by a change in the environment; the solution will encourage Kirtland’s Warblers to continue to survive.* |
| Evaluate | Student teams will investigate the impact of a local changing habitat and the implications of that change on plants and animals. They will compare and analyze possible solutions to the problem and how each of the solutions will impact the plants and animals in the changing habitat. |
### Lesson Plan

**Focus Question:** What is the purpose of maps?

**Phenomena:** Michiganders use their hands to show where they live

**Investigation Question:** Why do Michiganders use their hands to show where they live?

**Materials Needed:**
- Summary table
- Video of hand as a map
- Book List available through MeL

**Handouts Needed:**
- Pre-assessment t-chart (optional)

#### What | How | Why
---|---|---
Pre-assessment- Optional (5 minutes) | Access the pre-assessment t-chart and have students complete only the one for IC1  
  - Only complete pre-assessment for IC 1  
  - This can be completed and stored in a digital notebook or printed off ahead of time and pasted in notebook  
  - Remind students that this is a brainstorm and there are no right or wrong answers -- only opportunities to LEARN!  
  - Allow students approximately 5 minutes to complete the t-chart independently | To access prior knowledge and identify potential misconceptions.  

Engage 1 (10 minutes) | Show quick video of a person using his or her hand as a map  
  - Discuss the phenomenon: Michiganders use their hands to show where they live.  
    - Possible discussion questions -- use talk moves:  
      - Can all places be demonstrated with a hand?  
      - Are there limitations to this “map”? | Get students thinking about maps in a different way.  
  
  **Science discourse** is a powerful strategy and critical for students to build understanding.  

Summary Table Entry (10 minutes) | Introduce the **Summary Table** to the class  
  - 7-minute whole class discussion  
    - Spend a couple minutes making observations on the video and their experiences with maps.  
    - Keep a whole class summary table and work to elicit wonderings by using talk moves that will help drive the investigations in future lessons: Where can we find water on maps? What landforms can we find? Does Michigan have unique landforms? Are all maps alike? Can we map our school, town, etc?) | Give students a voice in the investigations.  
  
  **Summary Tables** allow students to track how various investigations and activities help them build understanding toward the focus question.
Doing Science to Learn Science While actively engaged in practicing science process to learn content and build conceptual understanding, students are developing understanding of science as a way to solve problems and make sense of the world.

**Anchoring Phenomena**

**Multiple Iterations** Students require more than one opportunity to construct understanding of a phenomena.

**Investigations** Hands on explorations of phenomena are critical for concrete elementary thinkers

**Modeling** Engaging students in developing, using, and revising their own models

**Summary Tables** Sometimes used in the form of “KLEWS Charts,”

**Scientific Method vs Methods of Scientists**

**Science-Driven Integration of ELA / Math / Technology**

**Exploration Stations** Also called Science Centers or Science Tables
PS Instructional Strategies, continued

**Making Thinking Visible / Audible** Throughout each cycle, particularly while engaged in the Science and Engineering Practices, students will make their thinking visible or audible to the teacher and especially for peers. Using these strategies, students are making their thinking visible / audible to build the teacher-student feedback loop

- **Science Notebooking**
- **Class Question Maps** Also called “Driving Question Boards,”
- **Collaborative Groups**
- **Evidence-Based Investigations / Talk / Writing**
- **Explanatory and Argumentative Speaking and Writing**
- **Science Discourse / Talk Moves** Students first mode of processing is talk.
- **Concept Maps**
Teacher and Student Results

Through Implementation of Phenomenal Science
ENJOYED EDUCATION

TEACHING MATERIALS

CURRICULUM IDEAS

ENGAGED ACTIVITIES

LEARNING DISCUSSIONS

HANDS-ON EXPERIENCES

LEARNING OPPORTUNITIES

SCIENCES

NEW CONCEPTS

EXPLORATION

STUDENTS

INTERACTIVE LEARNING

RESEARCH

INQUIRY LEARNING

CONTENT

TEACHER SUPPORTED
Teachers participating in Phenomenal Science show substantial growth of +.8, or an 18% increase, on a 4-point scale in regards to their comfort levels with NGSS.
Teachers participating in Phenomenal Science show substantial growth of +.482, or an increase of 9%, on a 4-point scale in regards to their instructional strategies necessary to implement NGSS curriculum.
Everything was right there that was needed; videos, materials lists, and books to read aloud. It was wonderful how all the three dimensions are incorporated!

-Kindergarten Teacher

I love the hands-on components and encouraging dialog between kids to explore their own ideas and reasoning.

-1st Grade Teacher

Activities were hands on, engaging, appropriate for the grade level and included deep thinking questions.

-2nd Grade Teacher

Students had many opportunities for high-level thinking. Students were given the materials and expected to design and construct experiments based on their thoughts, questions and ideas.

-3rd Grade Teacher
I really enjoyed the student dialogue that these lessons fostered and their ability to construct arguments about the external and internal structures of plants and animals and the ways these supported growth, survival and reproduction.

~4th Grade Teacher

One of the strongest portions of the units is the amount of opportunity for student discovery and dialogue. After presenting a phenomenon to students, they were able to come to proper conclusions, on their own and as a class, that were later confirmed in informational text. The students were engaged and interested throughout the unit and could speak confidently while answering the investigation questions throughout the unit.

~5th Grade Teacher
How would you rate . . .

The PHENOMENAL SCIENCE Curriculum?

How interesting were the PHENOMENA?
How would you rate . . .

Hands-on EXPLORATION

Developing EXPLANATIONS
How would you rate ...
How would you rate...
How Can You Get Involved?
HOW YOU CAN GET INVOLVED

• Facilitator’s Training
• Unit Revision Sessions
• Phenomenal Science Rollouts
• Check out the Units
• Online Professional Learning

SIGN UP SHEET COMING AROUND
Visit Our Website

phenomscience.weebly.com
PHENOMENAL SCIENCE CURRICULUM ROLLOUT

DESCRIPTION

» This professional development series is designed for K-5 teachers intending to implement these units in their classroom during the upcoming year.

» The rollout is flexible to meet your district needs.

» Teachers will develop deeper understanding of the New Michigan Science Standards, Core Principles of Phenomenal Science, and develop their craftmanship with key Instructional Strategies to meet the new standards.

DETAILS

» Location: Your school or ISD

» Time: ½ or Full Day Sessions

» Sessions Needed: 1-5, Determined by number of Units to be implemented

» Cost: Contact SMTC for quote

PROFESSIONAL LEARNING PLAN

» Day 1: Shifting instruction to match the new Michigan Science Standards

» Days 2 - 5: Digging into the Units

Find out more
(989) 615-4372 | mcmah1ds@cmich.edu
## Unit K.2 It's Up to You to Make a Difference

**Unit Goals**

### Phenomenal Science Unit K.2: It’s UP to You to Make A Difference!

<table>
<thead>
<tr>
<th>Established Goals:</th>
<th>Transfer:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disciplinary Core Ideas</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Life Science</strong></td>
<td></td>
</tr>
<tr>
<td>- All animals need food in order to live and grow. They obtain their food from plants or from other animals.</td>
<td></td>
</tr>
<tr>
<td>K.ESS1.1: Use models to represent the relationship between the needs of different plants and animals (including humans) and the plants they like.</td>
<td></td>
</tr>
</tbody>
</table>

**Performance Expectation(s):** Students who demonstrate understanding can:

- K.ESS1.1: Use observations to describe patterns of water plants and animals (including humans) needed to survive.
Phenomenal Science Online Professional Learning

Investigate

Phenomenal Science Online Courses
hosted by Michigan Virtual

Introduction to Phenomenal Science
Using "Notebooking" in our Online Course

Notebooking is a Key Instructional Practice of Phenomenal Science and something you will ask your students to do as they learn science. To model this behavior, we strongly encourage you to keep your own Phenomenal Science learning notebook (a simple spiral bound notebook will suffice). Keeping a notebook as you work through this course will allow you to:

1. Build your own craftsmanship in science
2. Better understand how to best apply notebooks in your own classroom (tips, tricks, strategies)
3. Fully understand how notebooking builds understanding

During our time together, we will ask you to reflect in three ways: individually, in a group, and through an extended response. The three reflection types are highlighted in detail below.

Individual Reflection Questions
Individual reflection questions will look like this. They will provide you time to reflect on your own personal feelings and experiences around a topic. They are meant solely for you, and they're designed to help you process how the content in the module applies to you personally. Your answers to these reflection questions should be recorded in your paper-based learning notebook.

Group Reflection Questions
Group reflection questions will look like this. They will link you to a discussion forum, where you will utilize the space to share ideas and learn from other participants in the course. They are meant to help you share your thoughts with other educators and see various perspectives on a topic.

Extended Reflection Questions
Extended reflection questions will look like this. They are similar to individual reflection questions in that they allow you to reflect on your own personal feelings and experiences around a topic. The difference is that these questions are more in-depth and require an extended response. Your answers to these questions will be recorded through an online submission form.
Thank You!

• CONTACT INFO:
  • DARCY MCMAHON, mcmah1ds@cmich.edu
  • MATT SAMOCKI, samoc1mj@cmich.edu

• SIGN UP SHEET COMING AROUND