Getting Through the Modeling Cycle: 
Supporting students in sense-making of a phenomena in a PBL environment?

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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.

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What will we do today?

1. Build understanding about modeling in PBL environment

2. Model teach modeling through Health in Our Hands

3. Discuss how to support students in building and revising models.
6th grade unit
Health in Our Hands: What controls my health?

A PBL curriculum that engages students in modeling practice
Funded by NIH-SEPA
Which PEs does the unit build towards?

**MS-LS1-5** - Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

**MS-LS3-2** - Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

**MS-LS1-3** - Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

**MS-LS4-4** - Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals’ probability of surviving and reproducing in a specific environment.

**MS-LS4-6** - Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
HIOH is a Project-based Learning (PBL) curriculum

Project based learning is a comprehensive approach to classroom teaching and learning that is designed to engage students in investigation of authentic problems

- **Pursue** solutions to a *meaningful question*
- **Explore** the question by *participating in authentic, situated inquiry* to “figure out” *why phenomena occurs*
- **Engage** in *collaborative activities* to find solutions
- **Use** *learning technologies and other scaffolds* to help students participate in activities
- **Create** *artifacts* that address the driving question and explain the phenomena

**PBL curricula can support in achieving the goals of NGSS**
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<th>Lesson</th>
<th>Driving Questions</th>
<th>Learning Goal</th>
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<td>Lesson 1</td>
<td>Why does Monique have diabetes?</td>
<td>Introduction</td>
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<td>Lesson 2</td>
<td>How can we describe Monique’s diabetes?</td>
<td>Diabetes</td>
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<td>Lesson 3</td>
<td>How does Monique’s family affect her diabetes?</td>
<td>Genetic component</td>
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<td>Lesson 4</td>
<td>How does where Monique lives and what she does affect her health?</td>
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<td>Lesson 5</td>
<td>How do Monique’s characteristics and environment affect her health?</td>
<td>Genes-environment interaction</td>
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<td>Lesson 6</td>
<td>What can Monique do to make her environment healthier?</td>
<td>Individual action</td>
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<td>Lesson 7</td>
<td>How can we work together to make our environment healthier?</td>
<td>Collective action</td>
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**Health in Our Hands: What controls my health?**
Pursue solutions to a meaningful question
Explore the question by participating in authentic, situated inquiry to “figure out” why phenomena occurs.

Plant simulation
Sand-rats simulation
Community projects
Engage in *collaborative activities* to find solutions

**Research questions for the community action projects**

How does raising students’ awareness to the amount of sugar they eat affect their food choices?

How does watching TV and playing video games affect children’s healthy lifestyle?

1. How do smoothies affect your health?
2. How can healthy smoothies attract consumers?

How does my neighborhood affect my exercise and walking habits?

What are the barriers to healthy eating, and how do these barriers affect children’s eating habits?

How does social media affect our feelings?
Use *learning technologies and other scaffolds* to help students participate in activities.
Create artifacts that address the driving question and explain the phenomena

https://concord.org/projects/building-models
What is a model? What is modeling?

Take a few minutes a talk with the people at your table to respond to the following questions:

• What is a scientific model?
• What does it mean to develop a model?
• What challenges do teachers have with using this practice with their students?
What is a model? What is modeling?

A scientific model...

• ...represents the objects and the relationships among them to *explain and predict phenomena*

• ...provides a *causal mechanism* that accounts for the phenomenon

• ...could be depicted as a drawing, diagram, 3-D, or other *representation*

• ...but *only* representations that explain and predict phenomena are scientific models

Models explain or predict *how* and *why* phenomena happen
The modeling cycle:

1. **Plan**: Plan a model based on what you know that can explain and predict the phenomenon.

2. **Build**: Build a model based on what you know that can explain and predict the phenomenon.

3. **Test**: Test your model: does it explain and predict the phenomenon?

4. **Revise**: Revise your model.

5. **Use**: Use your model to explain and predict the phenomenon.

6. **Share**: Evaluate your model: how does your model compare to other models?

7. **Revise**: Revise your model.

8. **Plan**: Plan a model based on what you know that can explain and predict the phenomenon.
Student Hat On
Meet Monique
a teenager struggling with type II

• Video Monique
What is affecting Monique’s health?

Plan

Monique’s health

List the components to help you answer the question:

“What is affecting Monique’s health?”
What is affecting Monique’s health?

Build

With a partner make your own model that answers the question “What is affecting Monique’s health? Choose 3-5 components and show how they affect Monique’s health.
What is affecting Monique’s health?

Test/Share

1. Test: see if your model makes sense.
2. Share: Why does Monique have diabetes? How can Monique reduce her symptoms of diabetes?
Teacher Hat On
Discussion

- What did you notice? What went well what was difficult for you and your group?
- How can you use the modeling cycle in your classroom to support students in creating models?
- Questions?
Scaffolds
Our Dream: Engaging students in constructing models throughout the K – 12 curriculum

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<th>Grades K - 2</th>
<th>Grades 3 - 5</th>
<th>Middle School</th>
<th>High School</th>
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<td>Develop a simple model that represents a proposed object or tool.</td>
<td>Develop and revise models collaboratively to measure and explain frequent and regular events.</td>
<td>Develop models to describe unobservable mechanisms.</td>
<td>Develop, revise, and use models to predict and support explanations of relationships between systems or between components of a system.</td>
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Thank you for joining us!

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HiOH website https://create4stem.msu.edu/project/misepa
HiOH curriculum https://create4stem.msu.edu/info/middle-school

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