Grade 3 ML-PBL Resources - Focus on Figuring Out

Lucas Project Workshop
CREATE for STEM Research Presenters
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Multiple Literacies in Project-Based Learning
A research partnership to develop 3-D+ Science Units for Grades 3-5

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What will we do this morning?

- Use examples from **Grade 3 Multiple Literacies in Project-Based Learning Units** to
  - Explore ML-PBL resources that support students in
    - figuring out phenomena
    - using NGSS practices, CCC, DCIs
    - developing literacy and mathematics skills
    - collaboration and discourse
  - Identify strategies for fostering collaboration, discourse, and agency in students.
  - Answer your questions.
Turn-and-Talk

How do you support students in making sense of phenomena?
ML-PBL Project Goals

- Meet NGSS; Support CCSS-Literacy, CCSS-Math
- Engage ALL students in sense-making
- Use language, literacy, and mathematics tools to develop usable science knowledge
- Build scientific dispositions (thinking like a scientist)

Our Solution

- Design, develop, test Integrated PBL Units for Grades 3, 4 and 5.
Our Challenge

Build learning environments that:

• Foster **deep** and **integrated understanding** of important ideas

• **Engage all** students in learning science

• Support students in developing important **scientific practices** and **21st century competencies**

• Support students in using **their knowledge** in science, mathematics and English language arts **to solve problems, make decisions and think innovatively**
Features of Project-Based Learning

Pursue solution to a *meaningful question (Driving Question)*.

Use big ideas to frame *3-D learning goals*.

Explore the question by participating in *scientific practices* to “figure out” why phenomena occurs and learn important *ideas* in the discipline.

Engage in *collaborative activities* to find solutions.

Use learning technologies and other *scaffolds* to help students participate in activities normally beyond their ability.

Create *artifacts* – tangible products – that address the driving question and represent student knowledge.
<table>
<thead>
<tr>
<th>Driving Questions</th>
<th>Major Topics</th>
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</thead>
<tbody>
<tr>
<td>Why do I see so many squirrels but I can’t find any Stegosauruses?</td>
<td>Animal Adaptations/ Natural Selection/ Climate</td>
</tr>
<tr>
<td>How can we design fun moving toys that other kids can build?</td>
<td>Force and Motion</td>
</tr>
<tr>
<td>How can we help the birds near our school grow up and thrive?</td>
<td>Plant and Animal Adaptations/ Natural Selection/ Biodiversity</td>
</tr>
<tr>
<td>How can we grow food for our community?</td>
<td>Weather and Climate/ Plant Growth</td>
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</table>
How do the units build on each other?

- Structure of Traits
- Designing for Structure
- Function of Traits
- Designing for Function

Structure and Function as the Crosscutting Concept

Developing Models as the Scientific Practice
How can we help the birds near our school grow up and thrive?
Building toward the following Bundle of PEs

LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

3-LS2-1. Construct an argument that some animals form groups that help members survive.

3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
How do we move further? How do I support students in reaching a PE?
Building Knowledge and Acquiring Domain Discourse

Questions
Elicit background knowledge and experiences

Investigation
Experience, observe and describe new understanding

Domain-based Discourse
Using and acquiring the language needed for answering the DQ, explaining the phenomenon, and solving engineering problems.

Modeling
Make apparent and amplify ideas for use.

Communicate
Gather and synthesize disparate ideas
Teacher Moves

1. Help a student clarify his/her thinking
2. Make ideas public
3. Emphasize a particular idea
4. Help students listen carefully and think about one another’s ideas
5. Help students deepen their reasoning
6. Help students apply their thinking to others’ ideas
# Teacher Talk/Discourse Moves

<table>
<thead>
<tr>
<th>Teacher Discourse Moves</th>
<th>1. Help a student clarify his/her thinking</th>
<th>2. Make ideas and thinking public and available for discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Help a student clarify his/her thinking</td>
<td>Wait time: 20-30 seconds after questions and after responses.</td>
<td>“Tell us more about what you’re thinking.”</td>
</tr>
<tr>
<td>2. Make ideas public</td>
<td>“Can you say some more about that?”</td>
<td>Clarify/repair how idea is expressed, without overriding student’s ownership.</td>
</tr>
<tr>
<td>3. Help students listen carefully and think about one another’s ideas</td>
<td>“Can you show us what you mean?”</td>
<td>“Did I say your idea correctly?”</td>
</tr>
<tr>
<td>4. Help students deepen their reasoning</td>
<td>“Can you draw that?”</td>
<td>Re-voice to connect everyday expression to more precise academic language.</td>
</tr>
<tr>
<td>5. Mark/emphasize a particular idea</td>
<td>“Will you tell us more about your thinking on that? Why do you think that works?”</td>
<td>“So, you’re saying...”</td>
</tr>
<tr>
<td>6. Help students apply their thinking to others’ ideas</td>
<td>“Would that always be true?” “Is there a condition that would make that false?”</td>
<td></td>
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<tr>
<td>7. Help students apply their thinking to others’ ideas; prompt peer-to-peer talk</td>
<td>“How could you show that that is true?”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>“How could we revise our model to account for this?”</td>
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<tr>
<td></td>
<td>“What new questions do you have now? What do we need to know more about now?”</td>
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</table>

- **Teacher Moves**: “Rebroadcast” an idea by revoicing, or ask a student to revoice or paraphrase to give an idea more exposure so everyone can hear it and think about it again.
- **Student Moves**: “That’s interesting. Can you say that again for us?” “Will someone re-tell that idea for us?”
Engage in Phenomenon

**Driving question:**
How can we help the birds near our school grow up and thrive?

**Lesson DQ:**
How are the birds near our school (the vulture, the chickadee, and geese) the *same* and *different* in important ways?
Engage in Phenomenon
Engage in Phenomenon
Driving Question Board

How can we help the birds near our school grow up and thrive?
Obtain information from text to solve a problem

https://www.allaboutbirds.org/
http://lef.imlc.io/#/fieldguide/2

Bird Field Guide
Modeling Design Solutions- What problems do birds have related to food near our school?
Questions to think about:

1. What special needs does your bird have for eating and holding food?
2. What kind of food does it need?
3. Where does your bird get its food?
4. When does the bird eat?
Modeling Design Solutions- What problems do birds have related to food near our school?

Modeling (sketch/draw) the solution

Develop a model of the engineering solution (how does it look, what is in it, where is it placed) and how it will match:
1. the physical and behavior traits of the bird, and/or
2. the evidence from resources outside, and,
3. The food needed that matches the evidence.

Will it solve the problem?
Modeling Design Solutions- What problems do birds have related to food near our school?

**Share out** with one other group, using the models.

-- 1 physical trait
-- 1 behavioral trait
-- Where is the food usually found, and how does your bird find it?

And **revise** solutions.
In Project Based Learning (PBL) environments, the “figuring out” process is driven by phenomena.

1. **We experience a phenomenon**
   - Observing birds → Anchoring phenomenon

2. **This raises a question**
   - DQ Board
   - Students ask their own questions

3. **This leads to using scientific practices**
   - Ask Questions
   - Gather Information
   - Develop Model

4. **We figure out some new things (and develop new questions)**
   - Resources
   - Birds need
   - Ways to help the bird
What does it mean to develop a model?

- 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.
Developing a model

• **Question**: What question is being explored about how or why something occurs or happens?

• **Plan**: What objects do you need in your model? What factors or variables are associated with each of the objects?

• **Build**: What relationships exist between each of the factors/variables?

• **Test**: Do the set of relationships you developed provide a causal account (i.e., does it explain the phenomena? does it account for all the evidence?)?

• **Revise**: Does your model still provide a causal account for any new evidence or other phenomena? How should it be changed?
Our Dream: Engaging students in constructing models throughout the K – 12 curriculum

Students of all ages and backgrounds can take part in modeling!

Greater Sophistication

<table>
<thead>
<tr>
<th>Grades K - 2</th>
<th>Grades 3 - 5</th>
<th>Middle School</th>
<th>High School</th>
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<tbody>
<tr>
<td>Develop a simple model that</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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<tr>
<td>represents a proposed object or tool.</td>
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A Concluding Message

- By focusing on core ideas integrated with scientific and engineering practices and crosscutting concepts, classrooms become learning environments where teachers and students engage in science to design and carry-out investigations and make and debate claims supported by evidence and reasoning.

- Such environments foster imagination, problem solving, communication capabilities and working together.
Thank You!

Questions???????

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