Language Demands and Opportunities of the Science and Engineering Practices for English Language Learners:

A Model Approach to Accelerate Learning

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3:15-4:30 PM
Goals

• Understand the language demands the science and engineering practices pose for ELs
• Explore the rich opportunities science provides for motivating student learning and academic language development
• Leverage the connections with the CA ELA/ELD Framework
Agenda

• Discuss NGSS Science and Engineering Practices
• Engage in academic conversations to understand science phenomena
• Identify best practices for ELD and science learning
Next Generation Science Standards

- Three Dimensional Learning
- Focus on deeper understanding
- Aligned with Common Core State Standards
## Disciplinary Core Ideas

<table>
<thead>
<tr>
<th>Life Science</th>
<th>Physical Science</th>
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<tbody>
<tr>
<td>LS1: From Molecules to Organisms: Structures and Processes</td>
<td>PS1: Matter and Its Interactions</td>
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<tr>
<td>LS2: Ecosystems: Interactions, Energy, and Dynamics</td>
<td>PS2: Motion and Stability: Forces and Interactions</td>
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<td>LS3: Heredity: Inheritance and Variation of Traits</td>
<td>PS3: Energy</td>
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<tr>
<td>LS4: Biological Evolution: Unity and Diversity</td>
<td>PS4: Waves and Their Applications in Technologies for Information Transfer</td>
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<table>
<thead>
<tr>
<th>Earth &amp; Space Science</th>
<th>Engineering &amp; Technology</th>
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<tbody>
<tr>
<td>ESS1: Earth’s Place in the Universe</td>
<td>ETS1: Engineering Design</td>
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<tr>
<td>ESS2: Earth’s Systems</td>
<td>ETS2: Links Among Engineering, Technology, Science, and Society</td>
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<td>ESS3: Earth and Human Activity</td>
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Crosscutting Concepts

Cause and Effect

Patterns
- Systems
- Scale
- Change and Stability

Structure and Function
- Matter and Energy
Science and Engineering Practices

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information
Science and Engineering Practices

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5-PS2  Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

5-PS2-1. **Support an argument that the gravitational force exerted by Earth on objects is directed down.** [Clarification Statement: “Down” is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

### Science and Engineering Practices

**Engaging in Argument from Evidence**

Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

- Support an argument with evidence, data, or a model. (5-PS2-1)

### Disciplinary Core Ideas

**PS2.B: Types of Interactions**

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1)

### Crosscutting Concepts

**Cause and Effect**

- Cause and effect relationships are routinely identified and used to explain change. (5-PS2-1)

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**Connections to other DCIs in fifth grade:** N/A

**Articulation of DCIs across grade-bands:** 3-PS2.A (5-PS2-1); 3-PS2.B (5-PS2-1); MS-PS2.B (5-PS2-1); MS-ESS1.B (5-PS2-1); MS-ESS2.C (5-PS2-1)

**Common Core State Standards Connections:**

**ELA/Literacy –**

RI.5.1  Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-PS2-1)

RI.5.9  Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-PS2-1)

W.5.1  Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-PS2-1)

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**SL.5.1 Engage in collaborative discussions**
What are Academic Discussions?
Productive academic discussions are not...
Productive academic discussions are...
Increase engagement of all students
Deepen understanding of content
Use academic language
Develop reasoning
Develop collaboration skills
What do you think you already know about air?

I think ____.
Focus Question 1

What happens when you place a jar over a burning candle? Why?

Turn and Talk:
*I predict ___ because___.*
Observe it!
Focus Question 2

What happens when you place a jar over a burning candle in 100 ml of water?
Materials
I predict ___ because ___.

Prediction

PredicMon

I predict ___ because ___.
In Table Groups

1. Perform the investigation.
2. Record observations.
3. Discuss what happened at your table.
4. Come up with an explanation.
Activity & Data Collection I

Do it!

Observe
Observations
Making Sense: Group Share

- In your groups take turns sharing your observations and inferences using an Academic Discussion Placemat.
Supports

Academic Discussion Placemat:
• Sharing own thinking
• Building on other’s ideas
• Challenging other’s thinking

<table>
<thead>
<tr>
<th>We Speak Like Scientists!</th>
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<tbody>
<tr>
<td>Scientists share their own thinking.</td>
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</tbody>
</table>
| I observed ______. | I agree with ___ and can add that ____. | I would argue that _____.
| Based on my observations, I think ____ because ____. | I want to build on your idea about ____: _____. | My data suggests something else: _____.
| For example, ____. | What ___ said about ___ makes me wonder _____. | Could you elaborate on why you think ______? |
Further Inquiry

• How can you gather more evidence to support your claim?
Focus Question 3

What happens when you place a jar over 2 or 3 burning candles in 100 ml of water?

Offer an explanation for what happened.
# Observations

<table>
<thead>
<tr>
<th>1 Candle</th>
<th>2 Candles</th>
<th>3 Candles</th>
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<tbody>
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Observations
Vocabulary Development

- oxygen
- pressure
- heat
- expand
- contract
Modeling in NGSS

The model has to be useful for helping **predict or explain** a system. If the model is only descriptive and doesn’t help to answer a question about how, or why, then it isn’t a scientific model.
Model

• Make a model to explain why the water goes into the jar.
Making Sense of Data

- With a partner, take turns using your model to explain your thinking.
- Use the new vocabulary words in your discussion.
  - Students A: “My model explains....”
  - Students B: “Can you say more about....”
Making Meaning: Science Talk

Sentence starters:

• I observed .....  
• I think... because...  
• I agree/disagree...  
• I wonder...
Science Talk

I think___, because___ .
I claim___. My evidence is ___ .
I agree/ disagree with ____ .
What I’m hearing is . . .

Why do you think that?
Can you say more about that?
CA ELA/ELD Framework

Reading, writing, and language practices are best taught and learned when they are employed as tools to acquire knowledge and inquiry skills and strategies within disciplinary contexts, such as science, history, or literature. The strands of reading, writing, speaking and listening, and language are integrated among themselves and across all disciplines.

(Chapter 2: Key Considerations in ELA/Literacy and ELD Curriculum, Instruction, and Assessment, pgs. 16-17)
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Interacting in Meaningful Ways

3 Communicative Modes

- Collaborative
- Interpretive
- Productive
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