Using **Maker** Experiences to Access NGSS and Integrated ELD Learning
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maker education: (noun) an opportunity and invitation for young people to develop confidence, creativity, and interest in science, technology, engineering, math, art, and learning as a whole through making
Long Term English Learners need daily structured opportunities, *invitation*, and support to share responses, collaborate with peers, and present ideas.

*Meeting the Unique Needs of Long Term English Learners*
Dr. Laurie Olsen
Maker Education is a powerful invitation.
“Weaving together science and language development can increase students’ academic performance in reading, writing, and science simultaneously.”
The student experience.
Why does the globe stay in place?
Do the **Wave**.
I notice...
I wonder...
I think...

Why did it happen this way?
Wave Investigation
I notice...
I wonder...
I think...

Why did it happen this way?
I notice...
I wonder...
I think...

Why did it happen this way?
Why does the globe stay in place?
Transverse Wave Model

- Wavelength
- Crest
- Trough
- Amplitude
DIRECTION OF ENERGY WAVE

Spring moves up and down

Transverse Wave

Particle Movement

Dir’n of Energy Transport
Creative Transverse Wave Models
What makes a good model?
Creative Transverse Wave Diagrams
Develop a 3D Model of a Transverse Wave

- **Choose** materials.
- **Develop** a model in groups of 3.
- **Identify**
  - Wavelength
  - Crest
  - Trough
  - Amplitude

Be prepared to use your model and any vocabulary needed to explain why the globe stays in place.
The **TEACHER** experience.
Students who demonstrate understanding can:
4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]

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

**Science and Engineering Practices**

**Developing and Using Models**
Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.
- Develop a model using an analogy, example, or abstract representation to describe a scientific principle.

**Disciplinary Core Ideas**

**PS4.A: Wave Properties**
- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. (Note: This grade band endpoint was moved from K–2.)
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).

**Crosscutting Concepts**

**Patterns**
- Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena.

Connections to other DCIs in fourth grade:
4.PS3.A ; 4.PS3.B

Articulation of DCIs across grade-levels:
MS.PS4.A

Common Core State Standards Connections:
**ELA/Literacy - SL.4.5**
Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-1)

**Mathematics - MP.4**
Model with mathematics. (4-PS4-1)

**4.G.A.1**
Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4-PS4-1)
Maker Activities and Content Connections
All standards, all students
All STEM teachers are responsible for ensuring that...

- their EL students have full access to an **intellectually rich** and comprehensive STEM curriculum.

- each EL student makes steady progress in **both** their academic content learning and their English language development.

*NGSS Framework, Chapter 10: Access and Equity*
SHARE responses
COLLABORATE with peers
PRESENT ideas

Meeting the Unique Needs of Long Term English Learners
Dr. Laurie Olsen
Seeing English Learners
An INVITATION.
CREATE
Investigate
Debate

SHARE
Communicate
Take Action

CHOOSE
Identify Problem
Question
Plan

Curiosity
Imagination

Disciplinary Knowledge
Critical Thinking
Regard for Evidence
Science and Engineering Practices

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information
MEANING MAKING is at the heart of instruction.
ENGLISH Learners
IT’S DIFFICULT TO
need instructional
concentrate on
SUPPORT TO BOTH
TWO DIFFERENT THINGS
Learn ENGLISH AND
at the same time.
CONTENT knowledge.
INSTRUCTIONAL FOCUS

<table>
<thead>
<tr>
<th>Away from</th>
<th>Towards</th>
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<tbody>
<tr>
<td>• Accuracy</td>
<td>• Collaboration</td>
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<td>• Grammatical correctness</td>
<td>• Comprehension</td>
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<td>• Communication</td>
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</table>
- reveals ideas as they are being thought out
- uncertain hypothesizing
- vague language
- reveals ideas as they are being thought out
- uncertain hypothesizing
- vague language

exploratory

presentational

- reveals ideas that have been thought out in advance
- polished explanations
- specific language
Be **intentional** and **strategic** about when and how to build in academic language.
Be **intentional and strategic** about when and **how** to build in academic language.
word banks

* Wavelength  * Crest  * Trough  * Amplitude
visuals/realia
I noticed that...
SO, WHAT I HEAR YOU SAYING IS...

revoicing
Be **intentional and strategic** about **WHEN** and how to build in academic language.
exploratory

visuals/realia

revoicing

presentational

word banks

sentence starters/frames
visuals/realia

word banks

exploratory

sentence starters/frames

revoicing

presentational
Be **intentional and strategic** about when **and** how to build in academic language.
New, relevant language is introduced to help students explain phenomena.

Students experience phenomena and use informal language to explore and explain.

Students use new language to explain phenomena, describe models, and make predictions about future occurrences.

New, relevant language is introduced to help students explain phenomena.

Invite Demonstration of new learning and language.
What actions can you take to give students in your context these experiences and opportunities?