From GLEs to LSSS

Moving from a checklist to a multi-dimensional science skill building process

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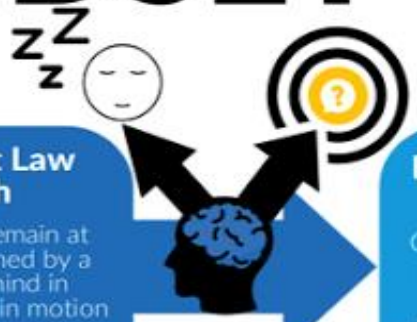
PHYSICS OF MINDSET GROWTH



Bentley's First Law of Growth

A mind at rest will remain at rest unless transformed by a powerful idea. A mind in motion may continue in motion with the same speed and in the same direction unless acted upon by a powerful idea.

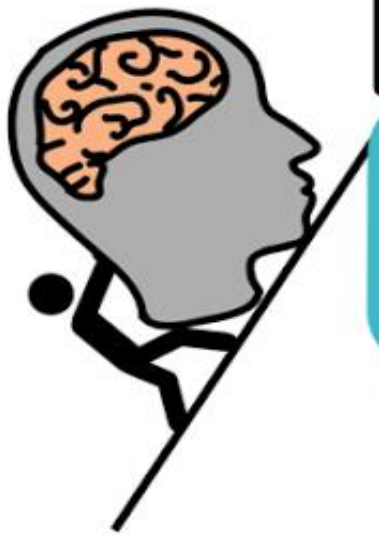
"Law of Mental Inertia"

Bentley's Second Law of Growth

Growth is produced when a powerful idea acts upon a mind. The greater the resistance put forth by the thinker the greater the time needed to accelerate growth.

Acceleration = Change in Resistance / Time

Growth = Resistance x Acceleration



Bentley's Third Law of Growth

For every opportunity to grow there is an equal and competing force to inhibit growth.

Growth

is not a given but the result of purposeful work, reflection, and a relentless willingness to overcome obstacles internal, external, and temporal.

Created by Jim Bentley. Follow on at @Curiosity_Films

Multi-Dimensional?

- Performance Expectation→ ultimately, what students must be able to do to show what they have learned
- Clarification Statement→ provides details, recommendations, and may include areas of emphasis or de-emphasis
- Science and Engineering Practices→ what scientists and engineers engage in to understand the world or to solve problems
- Crosscutting Concepts→ the "Big Ideas"
- Disciplinary Core Ideas→ foundational concepts

Science and Engineering Practices (SEP)

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

Crosscutting Concepts (CC)

- 1) patterns
- 2) cause and effect: mechanism and prediction
- 3) scale, proportion, and quantity
- 4) systems and system models
- 5) energy and matter: flow, cycles, and conservation
- 6) structure and function
- 7) stability and change

Disciplinary Core Ideas (DCI)

*Plants depend on animals for pollination or to move their seeds around

What animals move pollen from plant to plant?

Grade 2 PERFORMANCE EXPECTATION:

Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.*

What animals carry seeds on or inside their body to deposit somewhere else?

"Models and designs can be sketches, drawings, or physical models to communicate an idea to others"*

Multiple Dimensions = True Nature of Science

CODE	Performance Expectation
2-ESS2-2	Develop a model to represent the shapes and kinds of land and bodies of water in an area.
3-LS4-3	Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
MS-PS2-2	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on an object and the mass of the object.

	science and engineering practices
	disciplinary core ideas
	crosscutting concepts

Skill Progression Builds Year to Year

- K-2 → plant and animal parts and uses are spotlighted
- 3-5 → internal and external structures in plants and animals serve various functions for growth, survival, behavior, and reproduction
- 6-8 → cells, reproduction, structure and function of subsystems, and specialized systems
- 9-12 → the details: hierarchal systems of multicellular organisms, feedback systems, and more

So How Do You Plan?

Where are the **Louisiana State Science Standards** ?

http://www.louisianabelieves.com/resources/library/academic-standards

Access the LSSS and look at each Performance Expectation for your grade.

This would be a great time to sit with others of your grade level or of a grade band.

Take advantage of the availability of collaborators!

Example of a standard:

MATTER AND ITS INTERACTIONS

Performance Expectation	Develop models to describe the atomic composition of simple molecules and extended structures.
Clarification Statement	Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include carbon dioxide and water. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3-D models, or computer representations showing different molecules with different types of atoms.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
1. Asking questions and defining problems 2. **Developing and using models:** Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and/or use a model to predict and/or describe phenomena. 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	**STRUCTURE AND PROPERTIES OF MATTER** Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS.PS1.A.a) Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS.PS1A.e)	**SCALE, PROPORTION, AND QUANTITY** Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

Then…

- Read and/or copy the **Performance Expectation** and review the **clarification statement.** What must students be able to do?
- What do the **Disciplinary Core Ideas** indicate your students must know or be able to do to accomplish the PE?
- How will you stage **a rich, authentic experience** for your students that will promote student generated questioning, planning and carrying out of investigations, development of models, & data analysis?

"…Phenomena—real-world objects, systems, and events"*

- "The questions that students raise should be directly connected with the core ideas that you want students to engage with using the science and engineering practices."
- "Phenomena are commonly thought to be the "ewwww, weird, oh man!!" kinds of traditional science demos…"
- "Phenomena should drive units and keep students working to "figure out" rather than "learn about."

*http://www.project2061.org/publications/2061connections/2007/2007-05a.htm

Middle School – Chemical Reactions

- https://static1.squarespace.com/static/56e316c61bbee06d13210ed6/t/5756f5ae7da24f26ca7916ea/1465316789348/balloon.gif?format=750w

Sample Phenomena:

Genetics and Heredity (LS-3-HS)

- ***Most adults around the globe can't drink milk without getting an upset stomach.***
- For most adults around the world, drinking milk can cause an upset stomach. That's because they can't digest sugars in milk. Some humans have developed lactase persistence, however, meaning they keep the protein needed to breakdown sugars working into adulthood. This mutation is adaptive only in environments and cultures where humans have access to domesticated dairy animals.
- *Why can't most adults around the world drink milk without getting a stomach ache?*

A Process!

- Remember to cultivate a *Mindset of Growth*!
- Build a network of peers with whom to brainstorm and share!
- Find a partner, even if they are in a different grade or at a different school!
- Ask questions! Ask for help! *"Many minds make light work!"*
- *FEEDBACK, PLEASE!*

Thank You!

CSSS 2016 Workshop "Adapting Curriculum for 3 Dimensional Learning"
http://learndbir.org/talks-and-papers/csss-2016-workshop-adapting-curriculum-for-3-dimensional-learning

Phenomena for NGSS
https://www.ngssphenomena.com/whyusephenomena/

Differences in Phenomena: Early Elementary, Elementary, and Middle School
https://www.knowatom.com/blog/differences-in-phenomena-early-elementary-elementary-and-middle-school