



# INSPIRING SCIENTIFIC THINKING

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Science is about the miracle of the  
mundane -- and children  
appreciate this best.

Every child is a scientist!

~Susan Bosak

## OBJECTIVES

- x Review the significant shifts in science instruction
- x Dig into the components of NGSS instruction (it's a huge ask for our science teachers)
- x Explore what this means for US...how WE can help students think like scientists and figure things out



# 7 Significant Shifts of NGSS

1. K-12 Science Education Should Reflect the Interconnected Nature of Science as it is Practiced and Experienced in the Real World.
2. The NGSS are Student Performance Expectations – NOT curriculum.
3. The Science Concepts in the NGSS Build Coherently from K-12.
4. The NGSS Focus on Deeper Understanding of Content as well as Application of Content.
5. Science and Engineering are Integrated in the NGSS, from K-12.
6. The NGSS are Designed to Prepare Students for College, Career, and Citizenship.
7. The NGSS and Illinois Learning Standards for ELA and Math are Aligned.

# In Summary...

Lessons need to be PHENOMENA DRIVEN.

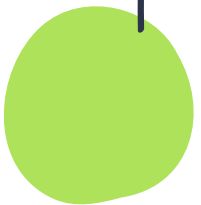
- shared experiences that inspire questions in our students

Lessons must be three-dimensional.

- STUDENTS must engage in the SEPs, CCCs, and DCIs in every lesson

The teacher will have a very different role!

- Shift from direct instructor to FACILITATOR



## 2 MAIN TYPES OF PHENOMENA

x Unit (Anchoring)



x Focus (Investigative)



# WHAT MAKES GOOD PHENOMENA?

- x Is this something **appropriate** for these students to figure out?
- x Can students **observe** and/or **investigate** the phenomena either firsthand or through someone else's experiences?
- x Does the activity **justify** the costs?

# WHY IS THIS SO IMPORTANT?

- x Equity in Science Education
- x Shared experiences
- x Rich conversation
- x Opportunities to revise thinking/questioning
- x “Student”-led educational experiences
- x To get students to **write** about science, they need to **talk** about science



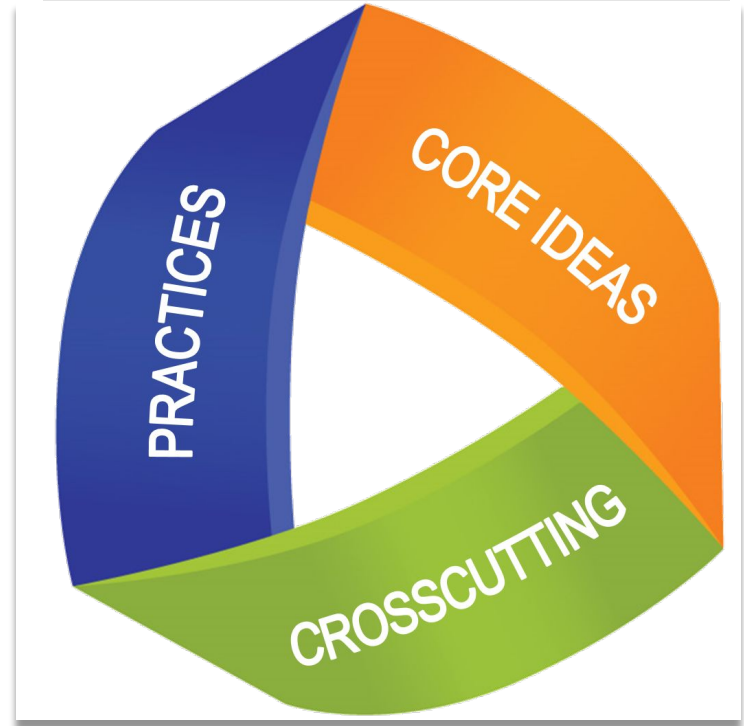


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# THREE-DIMENSIONAL LEARNING

## Integrating

- Scientific and Engineering Practices
- Crosscutting Concepts
- Disciplinary Core Ideas



# SCIENTIFIC 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

**How** students are learning about content...  
Skills to be developed in every grade level.

# CROSCUTTING CONCEPTS

1. Patterns
2. Cause and Effect
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter
6. Structure and Function
7. Stability and Change

**Why** students are learning about content...  
Underlying themes that permeate content in every grade level.

# Disciplinary Core Ideas

## • Physical Science

- Matter and Its Interactions
- Motion and Stability: Forces and Interactions
- Energy
- Waves and Their Applications in Technologies for Information Transfer

## • Earth & Space Science

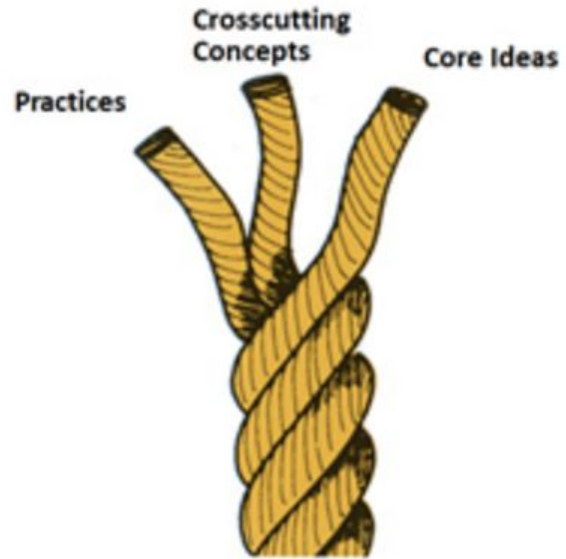
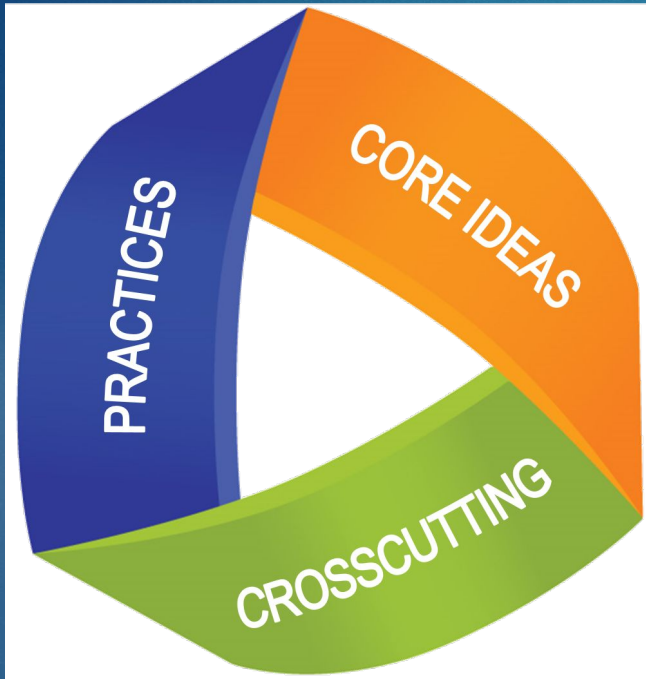
- Earth's Place in the Universe
- Earth's Systems
- Earth and Human Activity

## • Life Science

- From Molecules to Organisms: Structures & Processes
- Ecosystems: Interactions, Energy, & Dynamics
- Heredity: Inheritance & Variation of Traits
- Biological Evolution: Unity & Diversity

## • Engineering, Technology, & Applications of Science

- Engineering Design
- Links Among Engineering, Technology, Science and Society

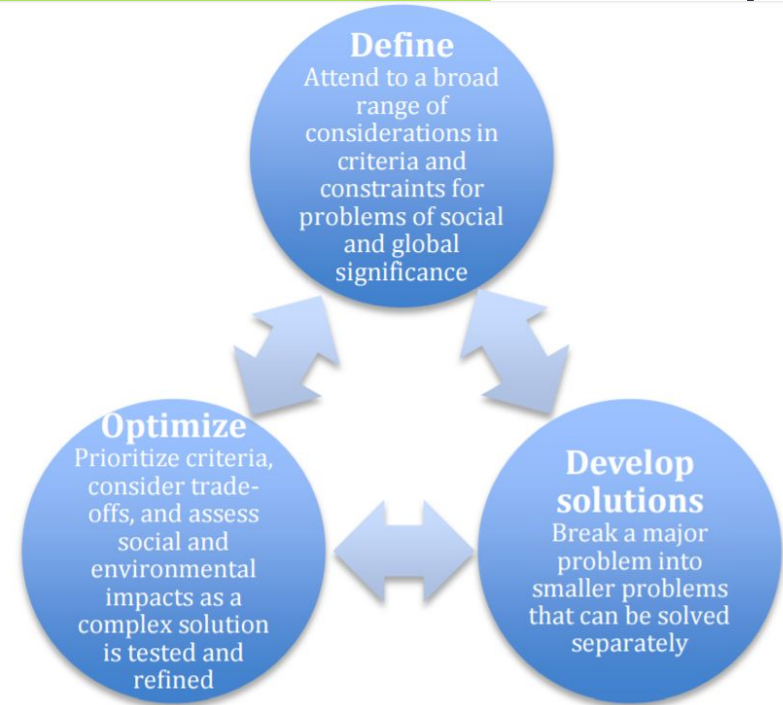


My "Aha"  
Moment...



# ENGINEERING IN SCIENCE

- x Iterative cycle of design that offers the greatest potential for applying science knowledge, results in technology





# THE PICKERSNAKE

- x Engaging Young Students in Engineering Design Process
  - x Children naturally look for solutions to problems
- x [https://drive.google.com/open?id=0B1Bei\\_RoQi3lRFNFSGMwc3JhWXc](https://drive.google.com/open?id=0B1Bei_RoQi3lRFNFSGMwc3JhWXc)
- x Did Jon engage in the complete engineering design process?
- x What could we do differently?



# DRIVING QUESTION BOARD

DOB: What happens to stars?

do they burn out?

lifespan?

do they burn? how?

How do stars affect planet formation?

how long does it take to get information about stars?

why will it engulf earth? (sun)

different colors?

Solar flare?

What are they made of?

How do stars form?

temperature?

Why do they give off light?

atmospheres on stars?

explode? black holes?

nebulae?

# SOLE: SELF ORGANIZED LEARNING ENVIRONMENT

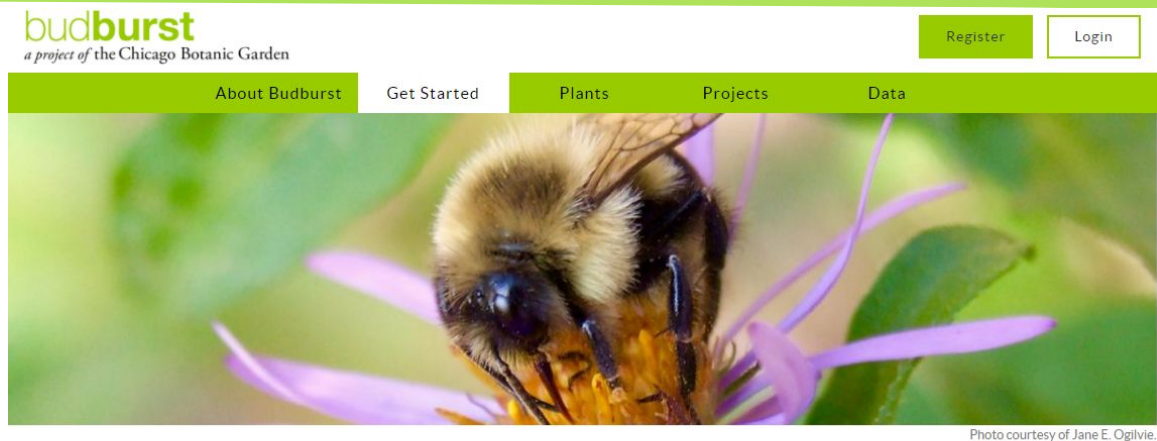


- Big Question
- Investigate
- Review

<https://startsole.org/>

<https://www.edutopia.org/blog/getting-started-self-organized-learning-environments-jacquelyn-omalley>

# WHAT LOCAL PROJECTS ARE AVAILABLE?



<a href="#">Learn How to Observe</a>
<a href="#">Observe Your Plant</a>
<a href="#">Report Your Observation</a>
<a href="#">Download Data</a>

## Get Started With Budburst!

Budburst is a national network of citizen scientists monitoring plants as the seasons change. On this page, **learn what to observe, how to make and report observations, and how to access Budburst data.**

## What to Observe

Watching plants and reporting what we see is the core work of Budburst. We watch for the key life events of a plant during the growing season. These events differ depending upon the type of plant but usually including leafing, flowering, and fruiting events. The study of these events is called phenology. Budburst observers benefit from knowledge of these topics:

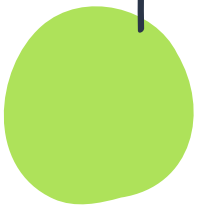
# WHAT LOCAL PROJECTS ARE AVAILABLE?



[HOME](#) [ABOUT](#) [LEARN](#) [HOST](#) [PARTICIPATE](#)



**Art  
Science  
Sky**



## RESOURCES:

- [Tech for Teachers - Science](#): A collection of resources to help teachers integrate science in their classrooms. From online labs and simulations to interactive periodic tables and video demonstrations, there are a numerous links to explore and implement.
- [Teachers Try Science](#): This website has several science lessons that have passed inspection using the NGSS EQuIP Rubric.
- [Data Nuggets](#): Data Nuggets are free classroom activities, co-designed by scientists and teachers, designed to bring contemporary research and authentic data into the classroom.

## PLACES TO FIND PHENOMENA:

- <https://impact.education.illinois.edu/phenomenafinder/phenomena-finder>
- <http://www.ngssphenomena.com/>
- <https://sites.google.com/site/sciencephenomena/>
- <https://dp.la/>
- <https://www.dogonews.com/>
- <https://www.sciencenewsforstudents.org/>
- <https://newsela.com/>
- <http://wonderopolis.org/>

## RESOURCES (LESSONS):

- [IMSA Model NGSS Lessons for Kindergarten - 3rd Grade](#): The IL Math and Science Academy has developed a series of K-3 NGSS lessons. Each lesson includes a Teacher's Page and student resources that are available to download and use in classrooms.
- [Next Generation Science Storylines](#): This website describes the process of developing a storyline, a coherent series of lessons that build students' knowledge of content through three-dimensional activities.
- [National Science Teachers Association Classroom Resources](#): A library of lessons, units, and activities vetted by NSTA curators who recommend revisions to make them more aligned with the vision of the NGSS.
- [The Wonder of Science](#): Phenomena, lesson ideas, and assessment examples organized by performance expectation.
- [The Inquiry Project](#) is a research project exploring the use of inquiry and investigative practices to deepen student understanding of matter for students in grades 3-5.



# THANKS!

Any questions?

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