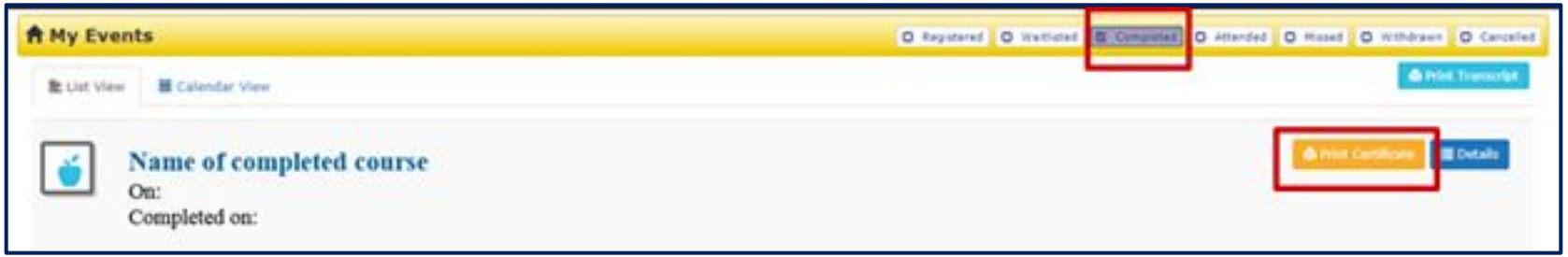
WELCOME!

Please review this information while we wait for all to join!

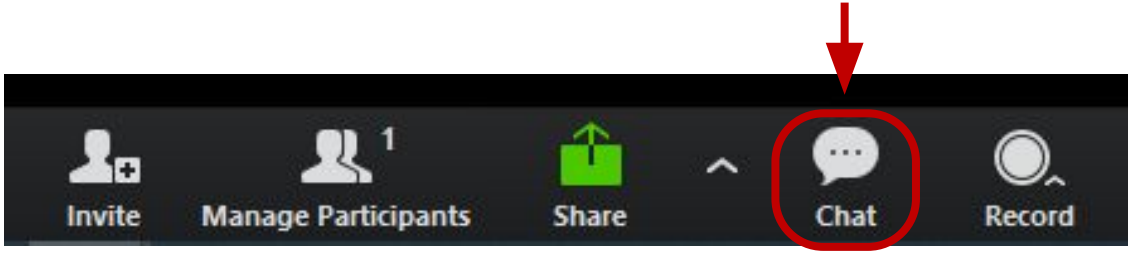
Attendance, Resources & PD Clock Hours

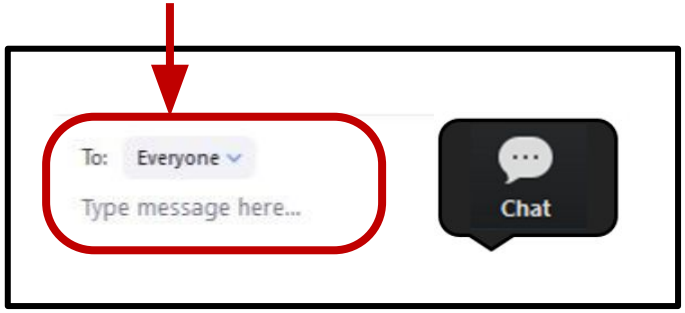
- You must stay on the whole time- 1.25 hours- to receive credit
- YOU print your certificate through ADE Connect (see image)- please wait 24-48 hours of webinar before printing certificates

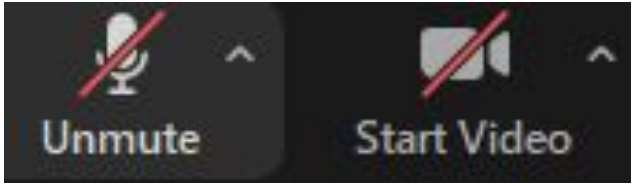


- AFTER WEBINAR- Survey & follow-up email from ADE

Webinar Housekeeping

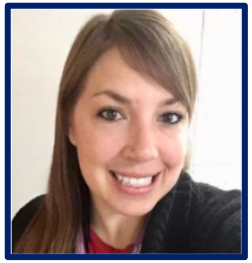






Arizona Department of Education

Phenomena-Based 3-Dimensional Instruction

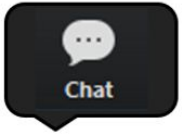


Rebecca Garelli
Science & STEM Specialist
Rebecca.Garelli@azed.gov

Sarah Sleasman
Science & STEM Director
Sarah.Sleasman@azed.gov

Arizona Department of Education

Welcome!



- Name
- Current Position
- County
- How did you hear about this PD?

Webinar Resource Dashboard

Phenomena-Based 3-Dimensional Instruction- Webinar Dashboard for 3.25.21

Facilitators: **Rebecca Garelli:** Rebecca.Garelli@azed.gov | **Sarah Sleasman:** Sarah.Sleasman@azed.gov

ADE Science Standards Page | ADE Science Resource Page | ADE Science & STEM Webinars

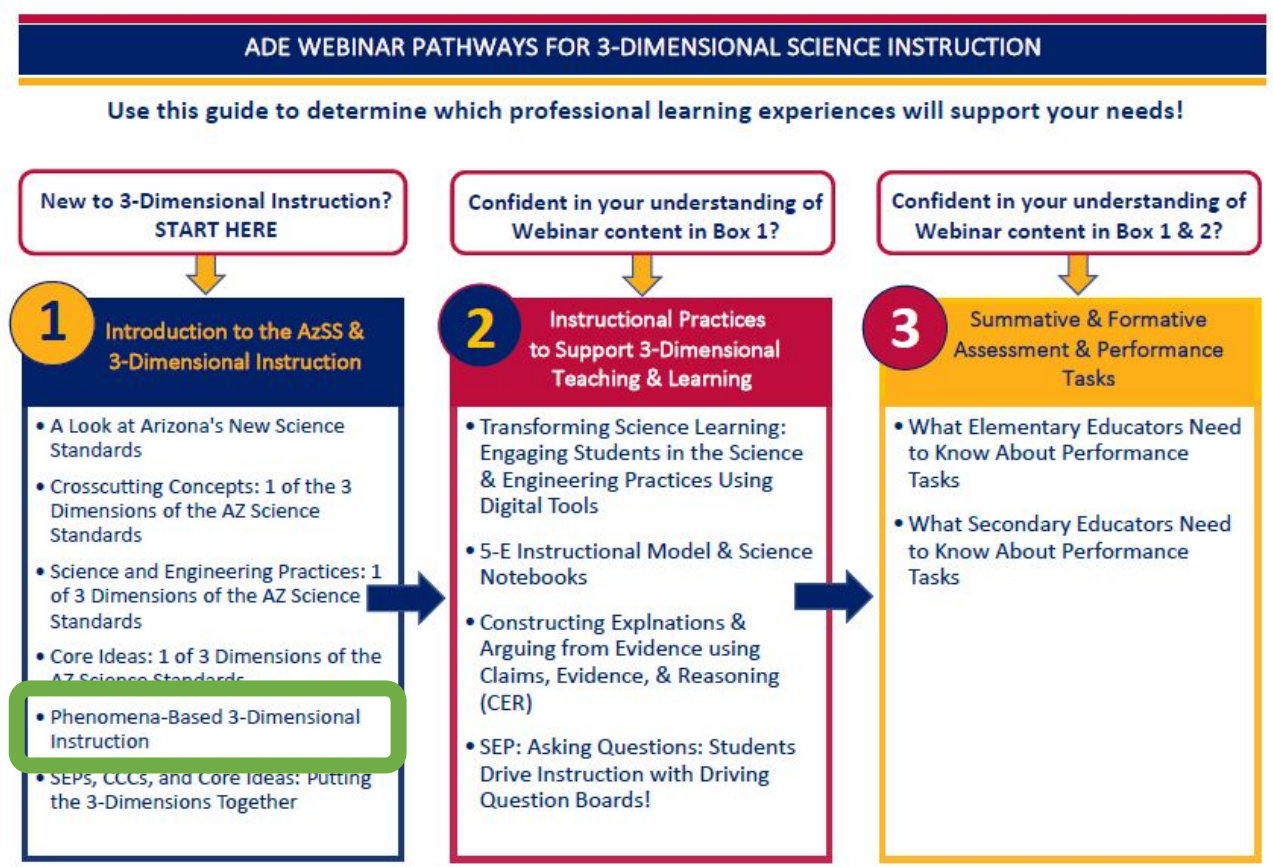
1	General Resources	⊕ Presentation PDF: PDF of Slides ⊕ ADE Webinar Pathways
2	Resources from Lessons Showcased in Presentation	⊕ More Picture-Perfect Science Lessons: Using Children's Books to Guide Inquiry, K-4 ○ Jamboard of Mystery Beads 5E Lesson ⊕ Ambitious Science Teaching Website ○ Tanker Car High School Video Gallery
3	Shifts in Instruction- More of, Less of	⊕ New Vision for Science Education
4	Two Research Documents Used to Develop the 2018 Arizona Science Standards	⊕ NRC Framework for K-12 Science Education ⊕ Working with Big Ideas of Science Education
6	NGSS: A Vision for K-12 Science Education Video	⊕ YouTube Video Link for NGSS: A Vision for K-12 Science Education
7	Become Familiar with the AzSS 3-Dimensions Structure	⊕ AzSS 3-Dimensional Snapshot for Educators & Administrators

MAKE A FORCED COPY

Gray- means we will open and use

Webinar Pathways

#1 in Dashboard



WHAT, HOW, WHY

- Gain a better understanding of the **instructional shifts** needed for three-dimensional science instruction and how this relates to the AzSS, including how phenomena relates to the AzSS
- Learn how to read the new AZ Science Standards and unearth the 3-dimensions of learning within the standard
- Explore how scientific phenomena can be used to drive standards-based instruction

Arizona Department of Education

Community Norms/Shared Agreements

- We honor each other and all our voices
- We actively and respectfully listen and speak to one another
- We commit to the group by contributing to the learning of others through active participation in this web seminar.

Adapted from NSTA's Webinar- Transforming Science Learning: Acting, Thinking and Talking as Scientists. Engaging Students in Science and Engineering Practices on 8/12/20

Access to Science Literacy for ALL Students

economically disadvantaged

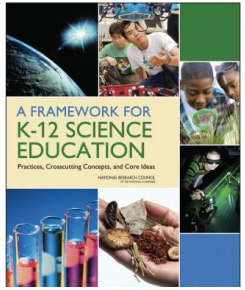
English learners

race and ethnicity

gifted and talented

students with disabilities

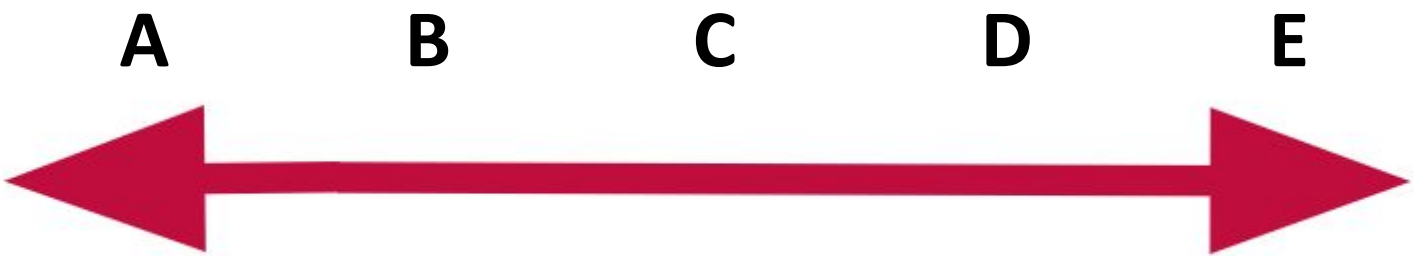
students with different cultures



Adapted from NSTA's Webinar- Transforming Science Learning: Acting, Thinking and Talking as Scientists. Engaging Students in Science and Engineering Practices on 8/12/20

2018 AZ Science Standards (AzSS) Comfort Level

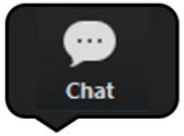
Where do you fall on this spectrum?



I know the 2018 AzSS exist, but just getting started

I am transitioning to the 2018 AzSS

I can confidently engage my students in 3-D instruction/AzSS



Instructional Shifts

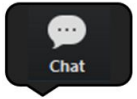
What would you see less of?

What would you see more of?

Alone Zone: Read & Think- What are two items that resonate with you?

Waterfall Chat

1. Type in chat- DO NOT HIT ENTER!
2. Wait for countdown...3..2..1



A New Vision for Science Education

Implications of the Vision of the Framework for K-12 Science Education and the Arizona Science Standards

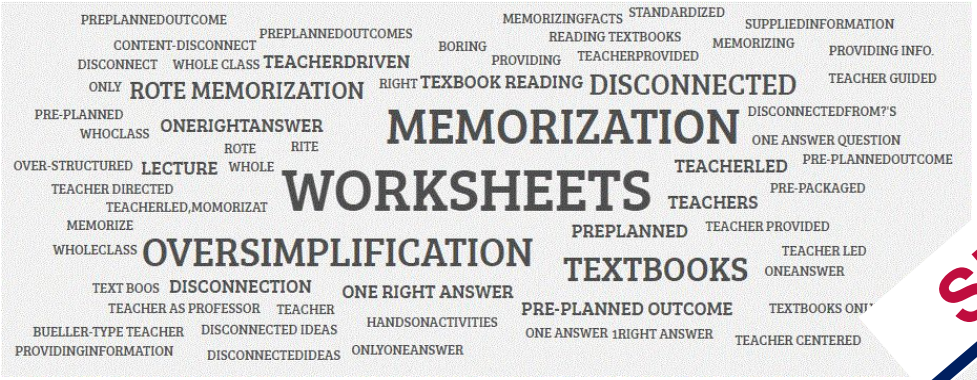
SCIENCE EDUCATION WILL INVOLVE LESS:	SCIENCE EDUCATION WILL INVOLVE MORE:
Rote memorization of facts and terminology	Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning.
Learning of ideas disconnected from questions about phenomena	Systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned
Teachers providing information to the whole class	Students conducting investigations, solving problems, and engaging in discussions with teachers' guidance
Teachers posing questions with only one right answer	Students discussing open-ended questions that focus on the strength of the evidence used to generate claims
Students reading textbooks and answering questions at the end of the chapter	Students reading multiple sources, including science-related magazine and journal articles and web-based resources; students developing summaries of information.
Pre-planned outcome for "cookbook" laboratories or hands-on activities	Multiple investigations driven by students' questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas
Worksheets	Student writing of journals, reports, posters, and media presentations that explain and argue
Oversimplification of activities for students who are perceived to be less able to do science and engineering	Provision of supports so that all students can engage in sophisticated science and engineering practices

Source: National Research Council. (2015). *Guide to Implementing the Next Generation Science Standards* (pp. 8-9). Washington, DC: National Academies Press. http://www.nap.edu/catalog/18802/guide-to-implementing-the-next-generation-science-standards

#3 in Dashboard

Less of this….. More of this…..

In a science classroom you would see less of.....



FIGURING OUT

In[illegible]e classroom you would see more of.....

SHIFT

LEARNING ABOUT

Two Labels for Instruction

Information Frame

- Teacher is focused on disseminating information.
- Students are focused on knowing information.
- Science is portrayed as a body of established facts.
- Assessments are focused on "right" answers.

Knowing about..

Sensemaking Frame

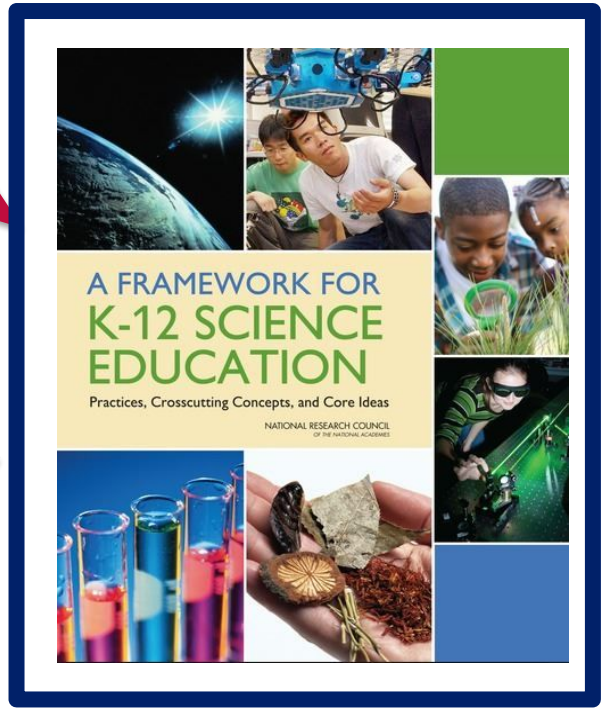
- Teacher is focused on developing conceptual understanding.
- Students are focused on understanding something.
- Science is portrayed as a way to make sense of something.
- Assessments are focused on use of evidence to support conclusions/generalizations.

Figuring out…

Adapted from NSTA's Webinar- Transforming Science Learning: Acting, Thinking and Talking as Scientists. Engaging Students in Science and Engineering Practices on 8/12/20

Research Used to Develop the 2018 Arizona Science Standards (AzSS)

NGSS



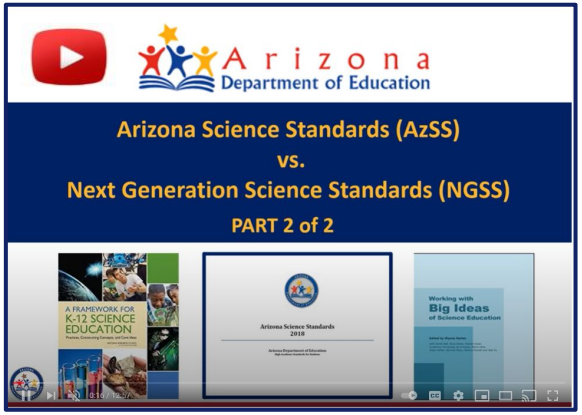
AzSS

AzSS

Not an NGSS State, a "Framework-Based State"

#4 in Dashboard

Resources on ADE Science Standards Website



Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 1st Grade

1st Grade Arizona Science Standards (AzSS)
Alignment to Next Generation Science Standards (NGSS)

The ADE acknowledges that the acronym "NGSS" is consistently used throughout science resources. To avoid confusion, we want to ensure the community understands that Arizona is not considered an "NGSS" state. To further clarify, AzSS and the NGSS were both designed using the research document, *A Framework for K-12 Science Education*. Both sets of standards include a strong focus on three-dimensional instruction, which includes: Science and Engineering Practices, Crosscutting Concepts, and Core Ideas. The major difference between the AzSS and the NGSS is that Arizona used an additional research document, *Working with Big Ideas of Science Education*, in the development of the Core Ideas of Knowing and Using Science.

Alignment of the AzSS to NGSS Performance Expectations

Note: An "S" or "P" alignment indicates that an NGSS resources could be used. An "NC" indicates that an NGSS resources cannot be used.

- **S = Strong: Both the Core Idea and Science and Engineering Practice (SEP*) are the same**
- **P = Partial: Core idea is closely related; SEP may or may not match**
- **NC** = Not Closely Correlated: There is no strong or partial correlation in this grade band**

**The bolded section of each standard refers to the Science and Engineering Practice that correlates to each standard. However, others should be utilized throughout the learning for this grade level. Naturally, one practice can lead to the use of others.*
***The NGSS performance expectation may be in a different grade level.*

Crosscutting Concepts: Patterns; **Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; **Stability and Change**
**Bolded crosscutting concepts are a focus throughout this grade level.*

Physical Science: Students develop an understanding of the effects of forces and waves, and how they can impact or be impacted by objects near and far away. They explore the relationships between sound and vibrating materials, as well as light and materials including the ability of sound and light to travel from place to place.

Arizona Science Standards- 1st Grade Physical		Next Generation Science Standards- 1st Grade Physical
1.P2U1.1 Plan and carry out investigations demonstrating the effect of placing objects made with different materials in the path of a beam of light and predict how objects with similar properties will affect the beam of light.	S	**1-PS4-3** Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam light.
1.P2U1.2 Use models to provide evidence that vibrating matter creates sound and sound can make matter vibrate.	P	**1-PS4-1** Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
1.P3U1.3 Plan and carry out investigations which demonstrate how equal forces can balance objects and how unequal forces can push, pull, or twist objects, making them change their speed, direction, or shape.	P	**K-PS2-1** Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

Link at TOP of Dashboard

What is 3-Dimensional Science Instruction?

What are the 3 Dimensions?

Science & Engineering Practices

Crosscutting Concepts

Core Ideas

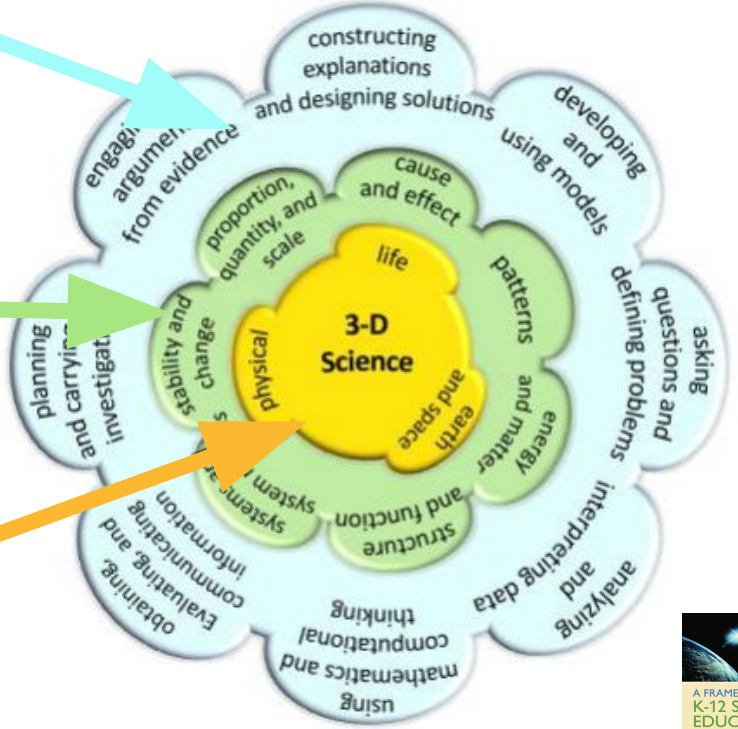
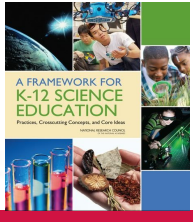
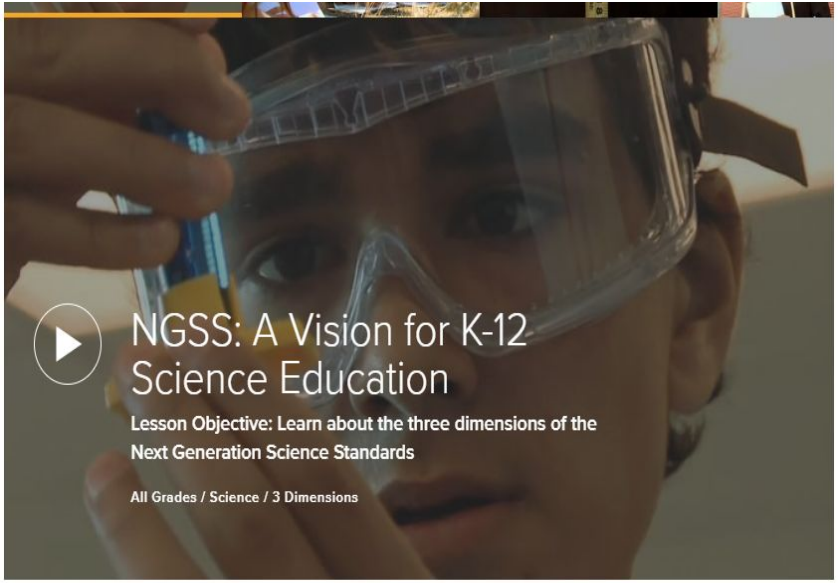
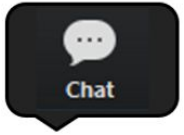


Figure 1: Three Dimensions of Science Instruction



What Is 3-Dimensional Science Instruction?





What examples of phenomena do you see in the video?

#6 in Dashboard

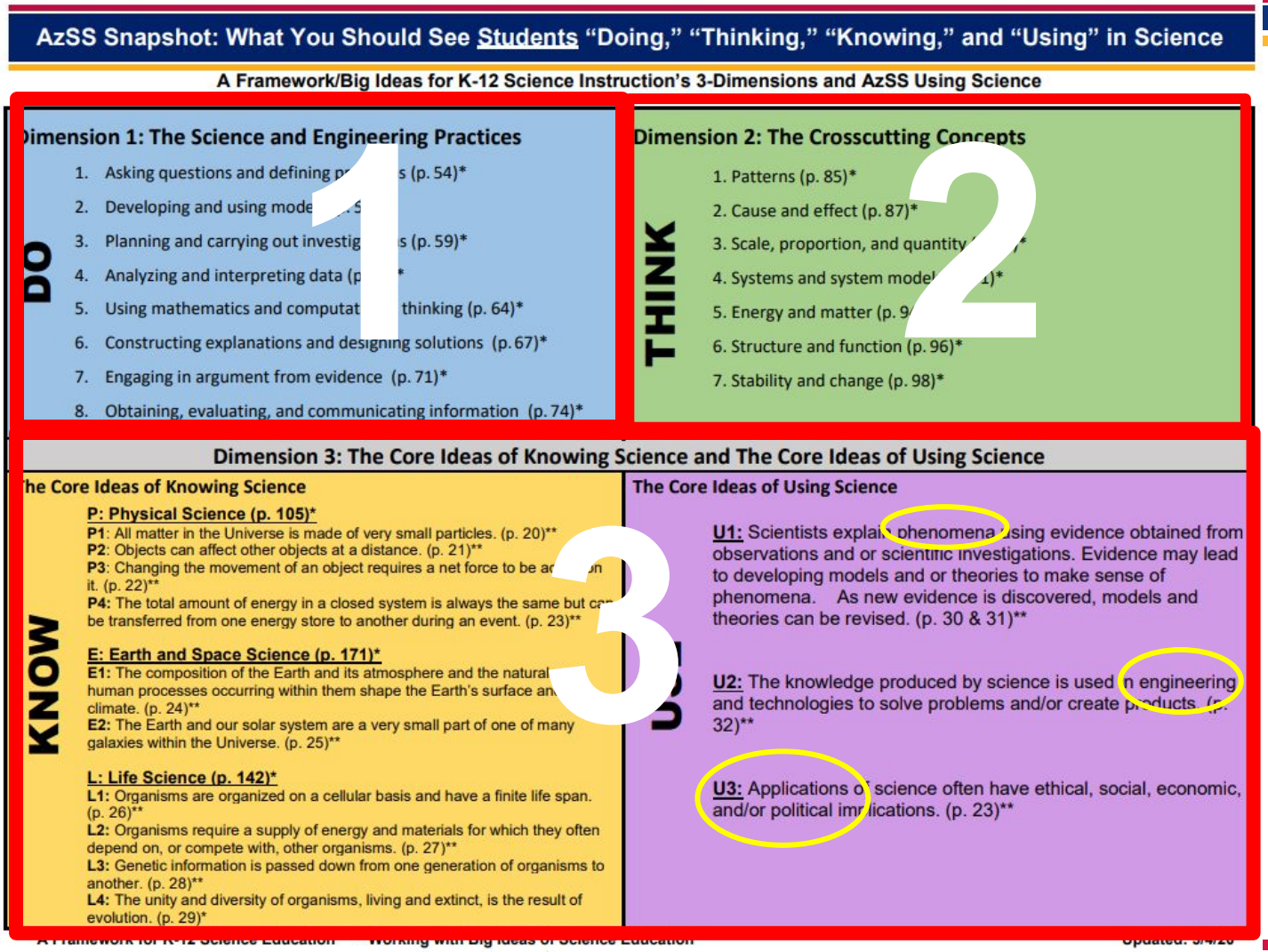
SEPs

The core ideas of **Knowing** science (CIs)

CCCs

Arizona Science Standards unique **Using** Science (CIs)

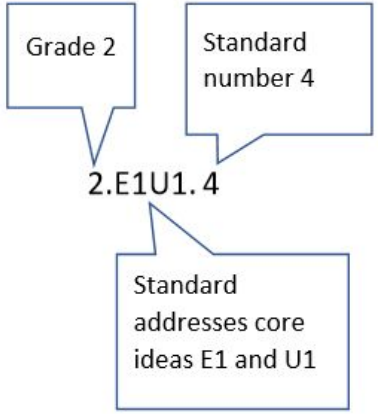
#7 in Dashboard



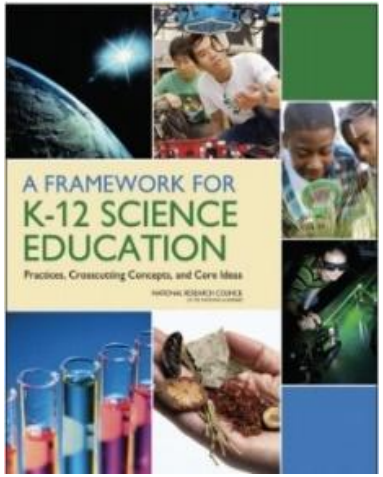
The Coding – How To Read It And How It's Useful

Earth and Space Standards
K.E1U1.3
Observe, record, and ask questions about temperature, precipitation, and other weather data to identify patterns or changes in local weather.

Earth and Space Standards
2.E1U1.4
Observe, describe, and predict how wind and water change the shape of the land resulting in a variety of landforms.



2.E1U1.4. Observe, describe, and predict how wind and water change the shape of the land resulting in a variety of landforms.

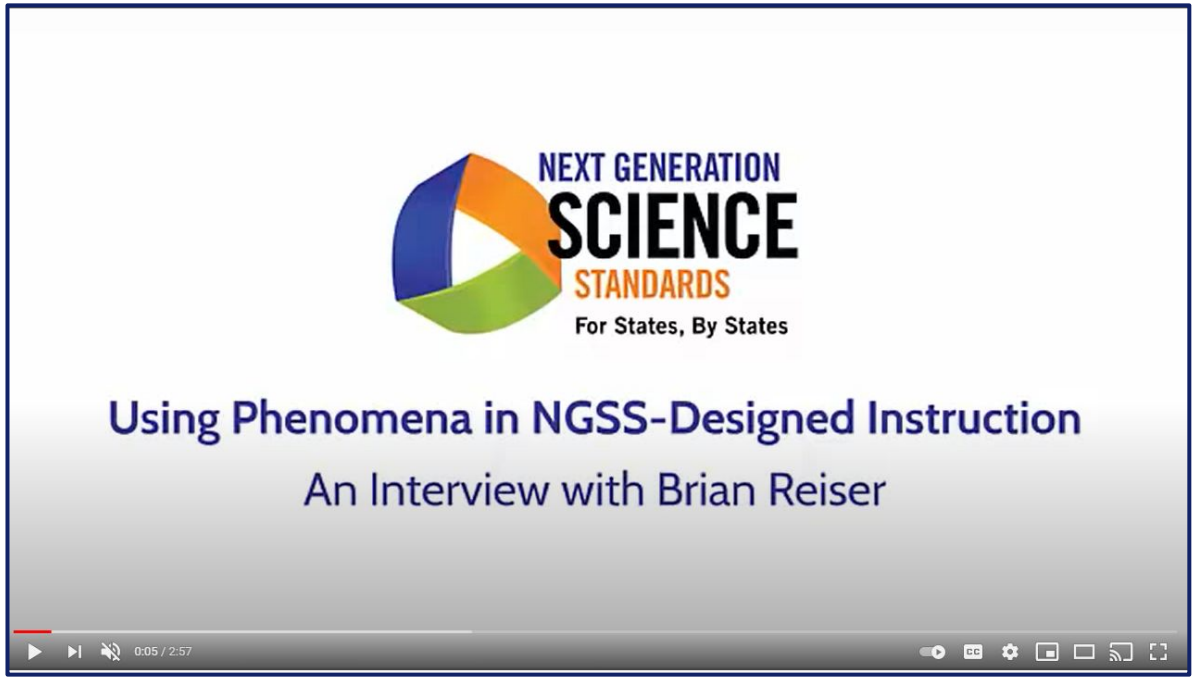


The word PHENOMENA (or phenomenon) appears 114 times in the Framework

The word PHENOMENA (or phenomenon) appears 97 times in our NEW AzSS

https://docs.google.com/document/d/1IiDM8E_5O3EYYrO9pnvu3f-yCHqC-byw1Anxym5pSCs/copy

Using Phenomena



https://www.youtube.com/watch?v=Jyiv1Lc0dng&feature=youtu.be

#9 in Dashboard

Chat

What are some possible things we could try and figure out or explore in this picture?

List as many as you can.

Phenomena = effect

Science seeks to explain the cause of the phenomena.

WHAT, HOW, WHY

- Gain a better understanding of the **instructional shifts** needed for three-dimensional science instruction and how this relates to the AzSS, including how phenomena relates to the AzSS

- Learn how to read the new AZ Science Standards and unearth the 3-dimensions of learning within the standard

- Explore how scientific phenomena can be used to drive standards-based instruction

Arizona Department of Education

Introducing a Phenomenon

1. Find a short video or piece of data to present or lead a demonstration / exploration with students.

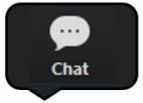
2. Show the video / present the data / explore the object or process, and get their ideas about questions they have about the phenomenon.

Phenomena Launch
(teacher lens)

1) Watch the video clip.

youtube.com/watch?v=Zz95_VvTxZM

2) Think about what science **content** the students need to know to explain this video.



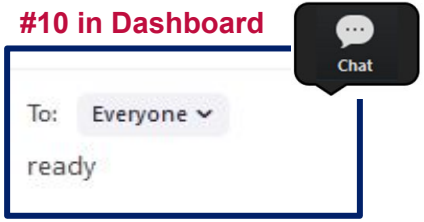
3) Share your thoughts in the chat box.

Notice & Wonder

(student lens)

Alone Zone

As you watch the video, record your observations, initial ideas and any **questions** that arise.



I notice/see (observations)	I think (initial ideas/prior thinking)	I wonder (questions)

Notice & Wonder

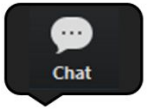
youtube.com/watch?v=Zz95_VvTxZM

I notice/see (observations)	I think (initial ideas/prior thinking)	I wonder (questions)

HOW OR WHY

Noticings Waterfall

Before typing in chat box:



I notice/see (observations)

- Review your observations
- Choose two observations to share
- Type in chat box, but DO NOT HIT ENTER!

(wait for countdown- 3,2,1..waterfall!)

When waterfall slows down:

Look for patterns & think

- Which observations did you share with others?
- Which observations were new to you?
- Add any new noticings to your S-T-W table

Adapted from NSTA's Webinar- Transforming Science Learning: Acting, Thinking and Talking as Scientists. Engaging Students in Science and Engineering Practices on 8/12/20

Wonderings Jamboard

Prepare for Jamboard

- Review your own observations and the observations of your group.
- Review and/or add to the questions you recorded in **“I wonder”** column of your table.

Post Questions on Jamboard

- Choose one question to share.
- **Share your question in Jamboard**

USE BLUE ONLY

What do we want to figure out?

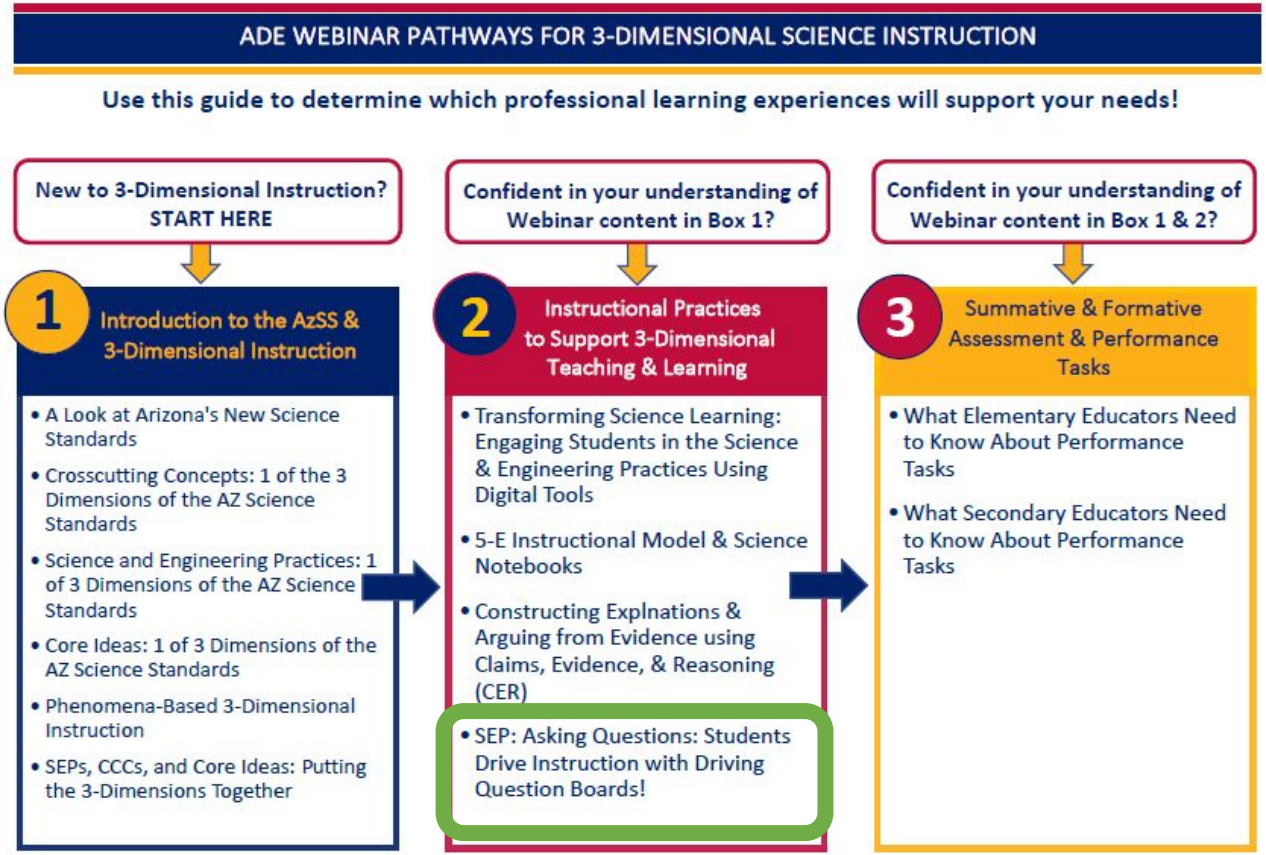
Record one question that helps us figure out: Why does the tanker car implode?

Jamboard (use your birthday month)

#11 in Dashboard

11	Jamboards by Birthday Month	Driving Question Board- July-December Driving Question Board- January-June

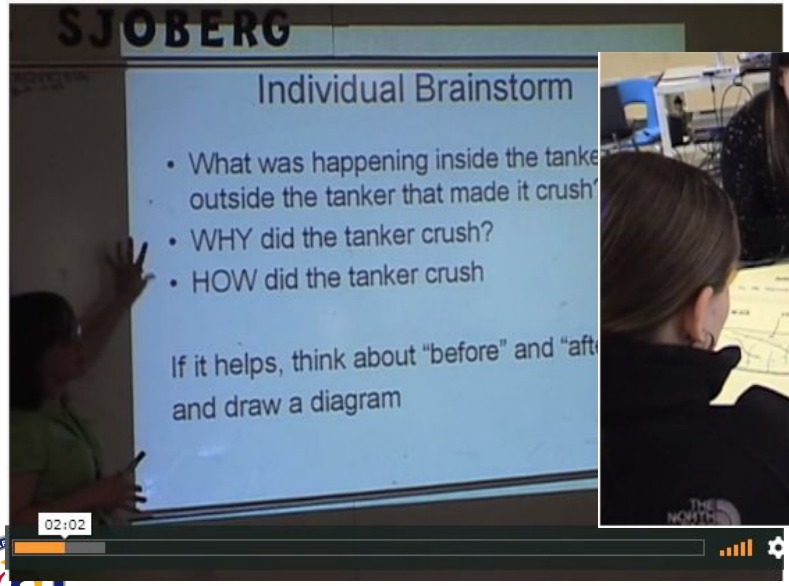
Asking Questions/Driving Question Board Webinar



If we were to continue this activity..

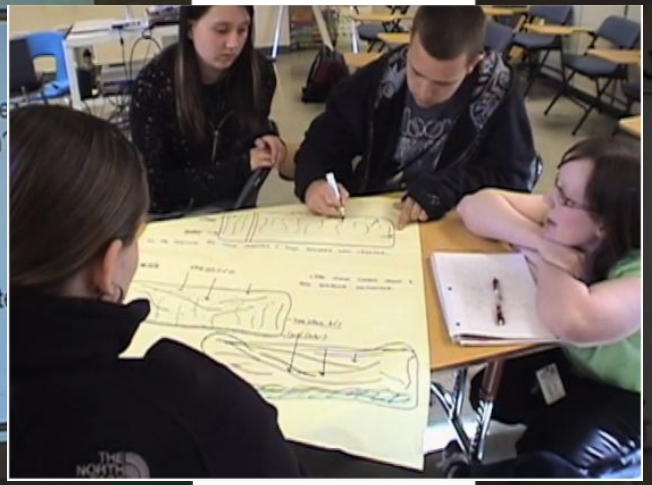
Students might…

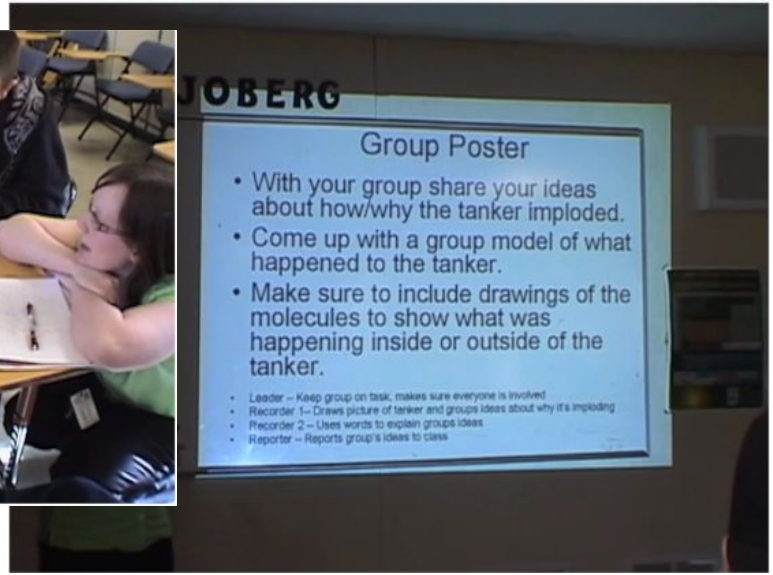
Draw an initial model of what they think is happening (individually)



And then…

Combine their ideas with other members of their group to make a Group or Consensus Model





Source: https://ambitiousscienceteaching.org/video-series/

#2 in Dashboard

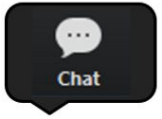
Debriefing the Launch

The launch presents the phenomena, setting up the expectation that they will **observe** some things that need investigating.

The launch involves **asking questions**, and therefore puts students in the driver's seat for a series of lessons.

The launch engages learners' **prior knowledge and related experiences** as resources for understanding.

The launch requires them to **prioritize** when to take up what questions, providing a possible learning pathway for them to pursue.



How is it different from what typically happens in science classrooms in your grade band? How is it different from how you learned?

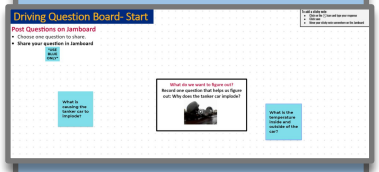
A Sequence to Promote Sense Making

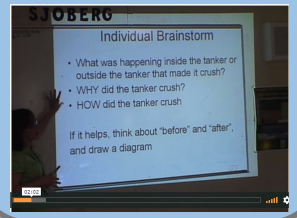
Phenomena

What was the event(s) in the world that happened that we need to explain?

Question

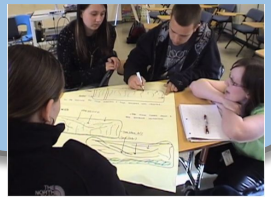
What about the phenomena do we need to explain?





Science & Engineering Practices

How are we modeling, explaining, etc. the phenomena, or designing a solution to solve the problem?

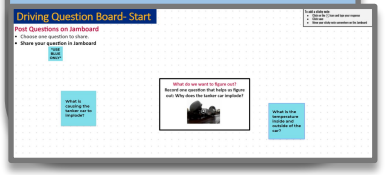


New Ideas

What did we **figure out** using these practices?

What pieces of the **CIs** or **CCCs** did we figure out?

What new ideas do we have? What **questions** do I have?

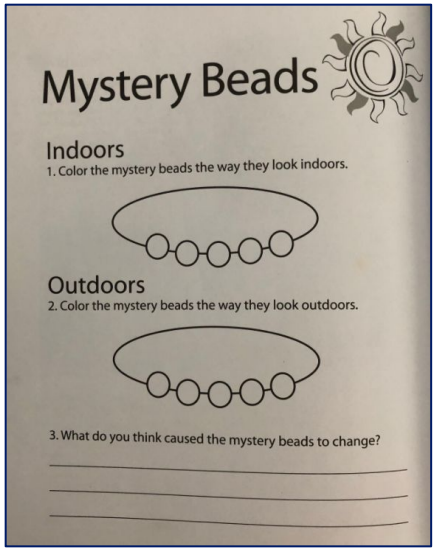


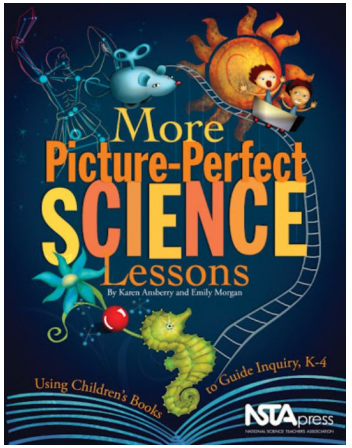
Design for Distance Learning

- Phenomena
- Science and Engineering Practices
- Student Ideas
- Classroom Norms

Adapted from NSTA's Webinar- Transforming Science Learning: Acting, Thinking and Talking as Scientists. Engaging Students in Science and Engineering Practices on 8/12/20

Elementary Experience- Mystery Beads





#2 in Dashboard- Mystery Beads- watch first!

Progressing towards---------->

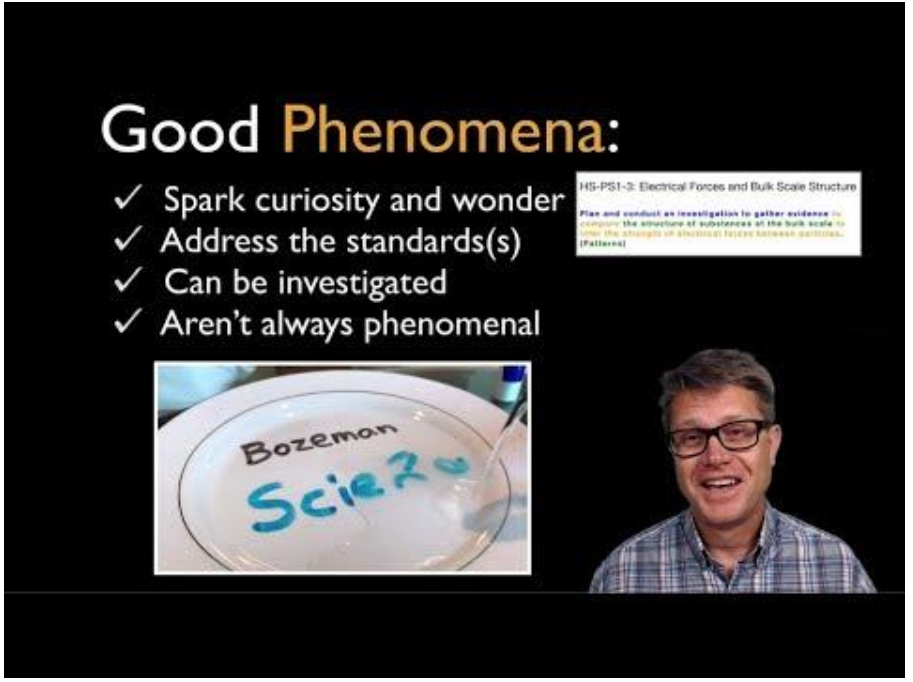
3.P4U1.3
Develop and use models to describe how light and sound waves transfer energy.

Phenomenon & Sensemaking

What exactly is a phenomenon?

An **observable event** that can be explained or explored using scientific practices, ideas, and concepts (the three dimensions).

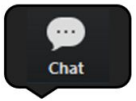
Helps students with sensemaking in science



youtube.com/watch?v=3ps3Js-psgo

#12 in Dashboard

Shifts in

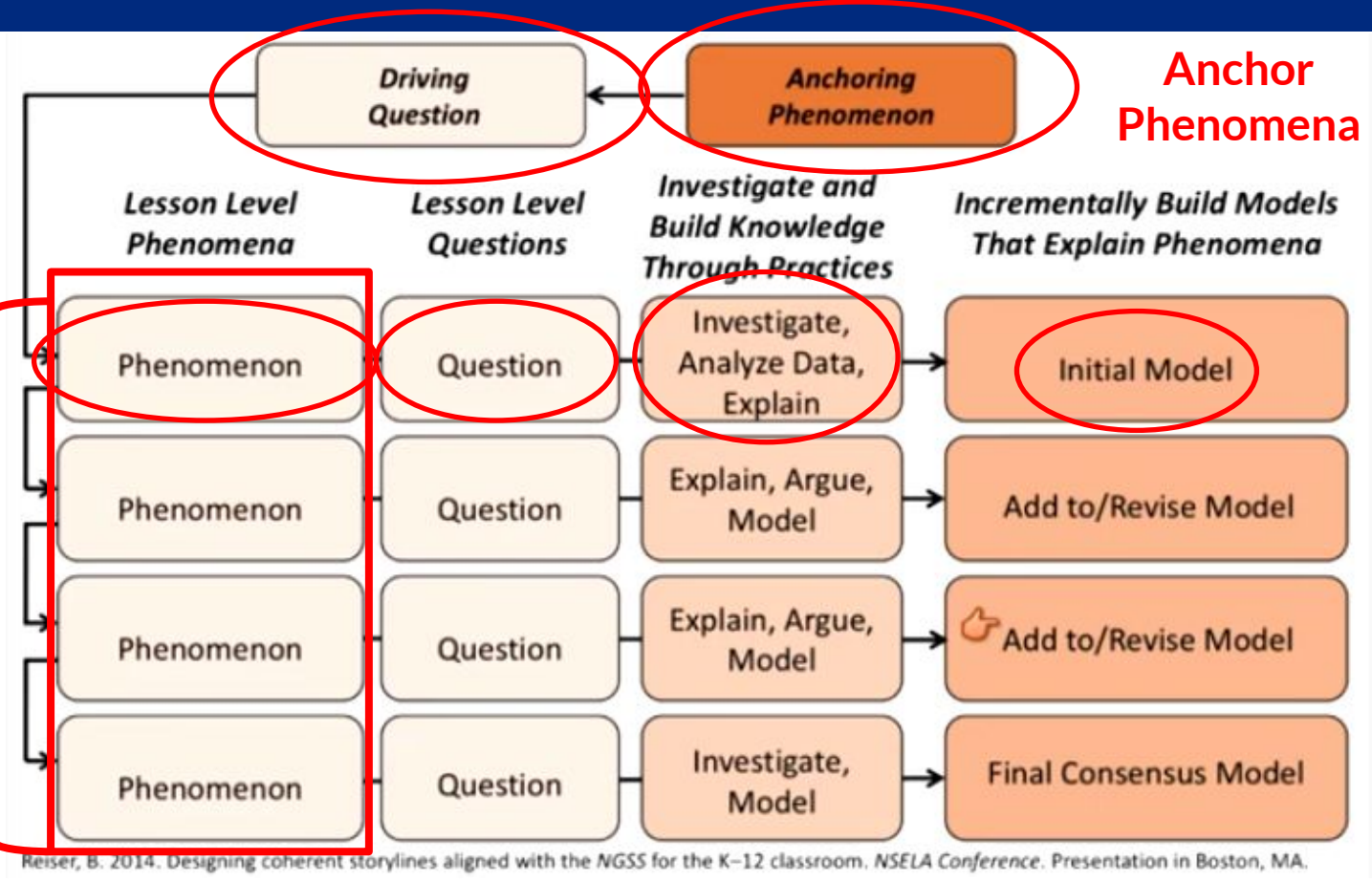


1. Read
2. Share one of the following:
   - A-ha! Moment
   - Quote
   - Connection

Prior Thinking About Phenomena	Thinking About Phenomena Through the AzSS
If it's something fun, flashy, or involves hands-on activities, it must be engaging.	Authentic engagement does not have to be fun or flashy; instead, engagement is determined more by how the students generate compelling lines of inquiry that create real opportunities for learning.
Anything students are interested in would make a good "engaging phenomenon"	Students need to be able to engage deeply with the material in order to generate an explanation of the phenomenon using target DCIs, CCCs, and SEPs.
Explanations (e.g., "electromagnetic radiation can damage cells") are examples of phenomena	Phenomena (e.g., a sunburn, vision loss) are specific examples of something in the world that is happening—an event or a specific example of a general process. *Phenomena are NOT the explanations or scientific terminology behind what is happening. They are what can be experienced or documented.*
Phenomena are just for the initial hook	Phenomena can drive the lesson, learning, and reflection/monitoring throughout. Using phenomena in these ways leads to deeper learning.
Phenomena are good to bring in after students develop the science ideas so they can apply what they learned	Teaching science ideas in general (e.g., teaching about the process of photosynthesis) may work for some students, but often leads to decontextualized knowledge that students are unable to apply when relevant. Anchoring the development of general science ideas in investigations of phenomena helps students build more usable and generative knowledge.
Engaging phenomena need to be questions	Phenomena are observable occurrences. Students need to *use the occurrence to help generate the science questions or design problems* that drive learning.
Student engagement is a nice optional feature of instruction, but is not required	Engagement is a crucial access and equity issue. Students who do not have access to the material in a way that makes sense and is relevant to them are disadvantaged. Selecting phenomena that students find interesting, relevant, and consequential helps support their engagement. A good phenomenon builds on everyday or family experiences: who students are, what they do, where they came from.

#13 in Dashboard

Central Role of Phenomena



Reiser, B. 2014. Designing coherent storylines aligned with the *NGSS* for the K–12 classroom. *NSELA Conference*. Presentation in Boston, MA.

Guidance for Selecting Phenomena

- ✔ Identify phenomena students could encounter in the real-world (classroom, lab, outdoors, home).
- ✔ Having data, or support information, is a plus, but not a requirement
- ✔ All three dimensions should be necessary to explain the phenomena
- ✔ Phenomena can be, but do not have to be, phenomenal.

Good Candidate Phenomena:

- ✔ Sparks curiosity and wonder- doesn't have to be "wow!," but more likely is a "huh?" experience
- ✔ Can be investigated
- ✔ Address the standard(s)

Do not select a phenomenon if it:

- Is peripheral to the subject content of the curriculum
- Does not surprise or generates little curiosity and the teacher has to do all the work
- Involves science concepts that are too difficult for students to grasp
- Is too complex for the students to solve, leading them to simply think of it as ‘magic’

Designing Phenomena-Based Instruction

AZ Science Standard

Core Ideas of Knowing & Using

What phenomenon can be explained using the core ideas?

Phenomenon

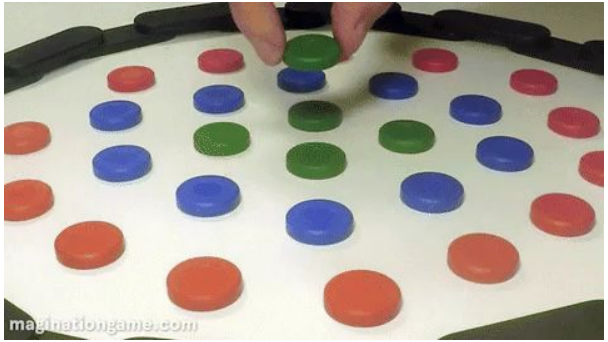
How will students interact with the phenomenon?

Science & Engineering Practice

What "lens" will students use to think about the phenomenon?

Crosscutting Concept

4.P4U1.1	U1: Phenomena/Sense-making
Develop and use a model to demonstrate how a system transfers energy from one object to another even when the objects are not touching.	



Energy and Matter

Systems & System Models

Crosscutting Concepts:
Patterns, Cause and Effect, Scale, Proportion and Quantity; **Systems and System Models**; **Energy and Matter**; Structure and Function; **Stability and Change**[4]

Designing Phenomena-Based Instruction

AZ Science Standard

Core Ideas of Knowing & Using

What phenomenon can be explained using the core ideas?

Phenomenon

How will students interact with the phenomenon?

Science & Engineering Practice

What "lens" will students use to think about the phenomenon?

Crosscutting Concept

3.L2.U1.8	U1: Phenomena/Sense-making
Construct an argument from evidence that organisms are interdependent.	

Systems & System Models

Structure & Function

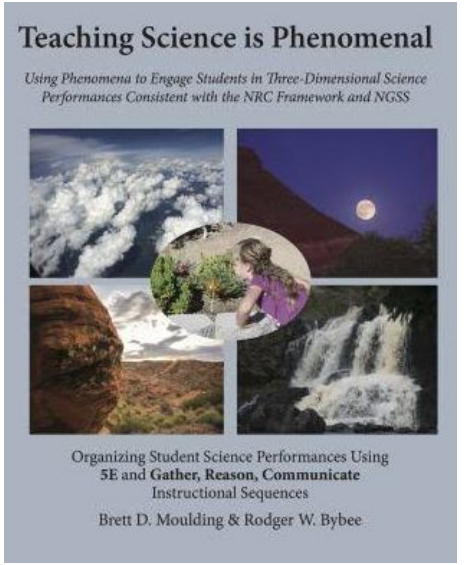
Crosscutting Concepts:

Patterns, Cause and Effect, Scale, Proportion and Quantity; **Systems and System Models**; Energy and Matter; **Structure and Function**; Stability and Change[4]

#12 in Dashboard

Phenomena Resources

LESSON & UNITS THAT INCORPORATE PHENOMENA		
15	Going 3-D w/GRC (Gather, Reason, Communicate) Lessons- FREE	#Going3Dw/GRC Lessons Website
16	National Science Teaching Association (NSTA) Resources- *Some lessons called "Daily Dos" are free, for full access membership is required*	Daily Dos: NSTA Daily Dos Sensemaking Lessons
17	Arizona Science Teachers Association (ASTA) Middle School Science Units- FREE	ASTA Middles School Units Based on Arizona Science Standards
18	OpenSciEd Instructional Units- FREE	OpenSciEd Open Resource Units
RESOURCES FOR FINDING POSSIBLE PHENOMENA		
19	Phenomena for NGSS	https://www.ngssphenomena.com/
20	Project Phenomena	https://www.ngssphenomena.com/
21	The Wonder of Science	https://thewonderofscience.com/phenomenal
22	Project SING Phenomena	http://questlc.org/phenomena/



Thank you for sharing this space with us tonight!

What questions do you have?

Use a strategy called “stack”- helps build a virtual “line” or stack

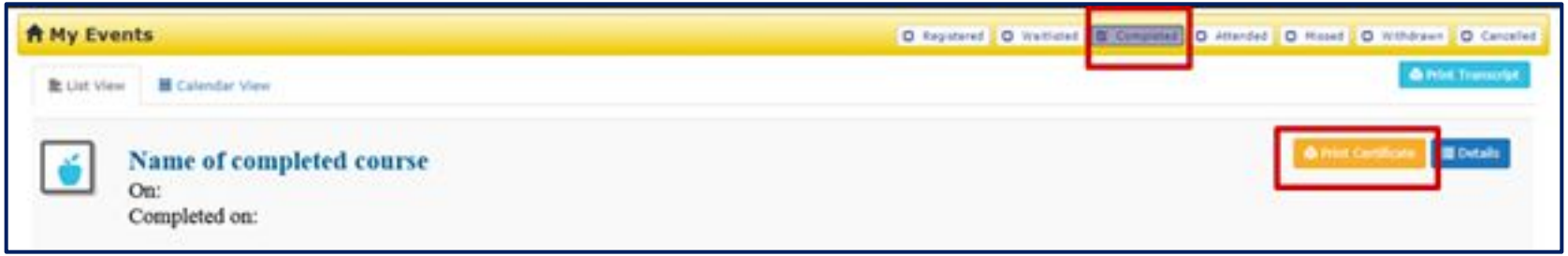
Rebecca Garelli I Rebecca.Garelli@azed.gov

REMINDER!

Please review this information while we wait for all to join!

Attendance, Resources & PD Clock Hours

- **You must stay on the whole time- 1.25 hours- to receive credit**
- **<u>YOU</u> print your certificate through ADE Connect (see image)- please wait 24-48 hours of webinar before printing certificates**



- **AFTER WEBINAR- Survey & follow-up email from ADE**