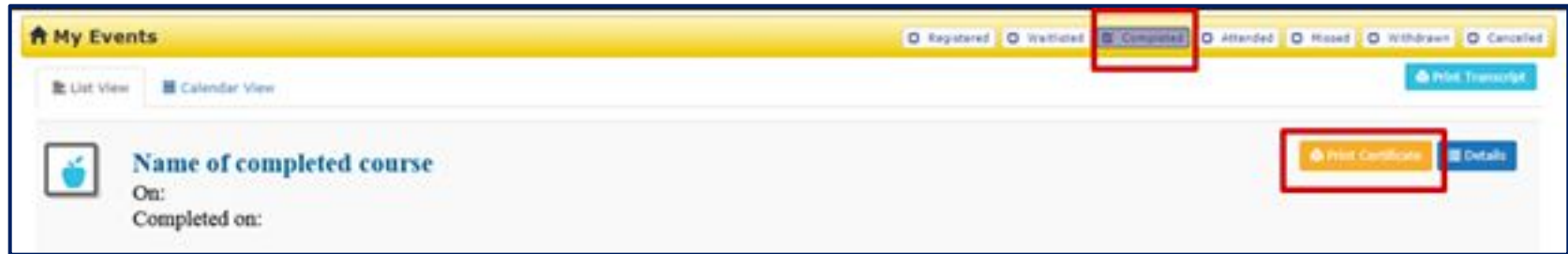


WELCOME!

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

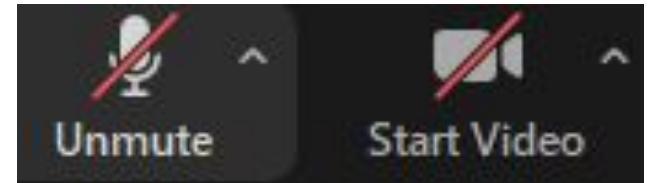
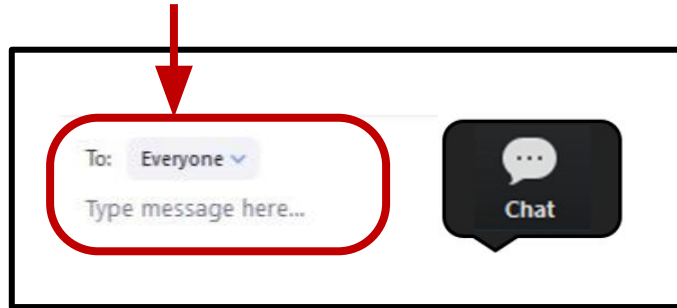
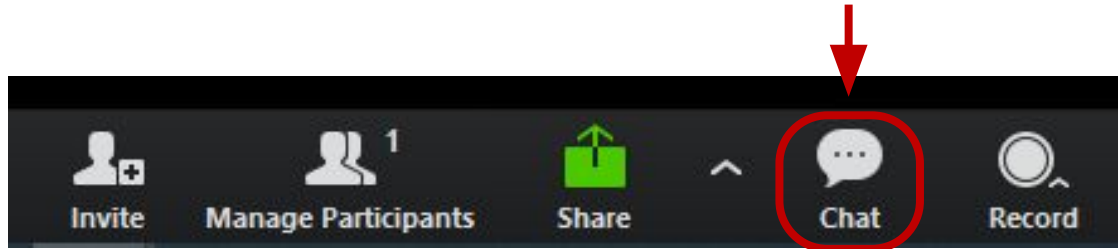
Attendance, Resources & PD Clock Hours

- 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



Phenomena-Based 3-Dimensional Instruction

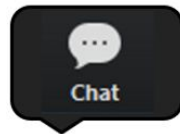


Rebecca Garelli
Science & STEM Specialist
Rebecca.Garelli@azed.gov

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



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

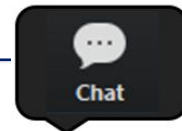
Facilitators: Rebecca Garelli: Rebecca.Garelli@azed.gov | Sarah Sleasman: Sarah.Sleasman@azed.gov

[ADE Science Standards Page](#) | [ADE Science Resource Page](#) | [ADE Science & STEM Webinars](#)

| | | |
|---|---|--|
| 1 | General Resources | <ul style="list-style-type: none"> ⊕ Presentation PDF: PDF of Slides ⊕ ADE Webinar Pathways |
| 2 | Resources from Lessons Showcased in Presentation | <ul style="list-style-type: none"> ⊕ More Picture-Perfect Science Lessons: Using Children's Books to Guide Inquiry K-4 <ul style="list-style-type: none"> ◦ Jamboard of Mystery Beads 5E Lesson ⊕ Ambitious Science Teaching Website <ul style="list-style-type: none"> ◦ Tanker Car High School Video Gallery |
| 3 | Shifts in Instruction- More of, Less of | <ul style="list-style-type: none"> ⊕ New Vision for Science Education |
| 4 | Two Research Documents Used to Develop the 2018 Arizona Science Standards | <ul style="list-style-type: none"> ⊕ NRC Framework for K-12 Science Education ⊕ Working with Big Ideas of Science Education |
| 6 | NGSS: A Vision for K-12 Science Education Video | <ul style="list-style-type: none"> ⊕ YouTube Video Link for NGSS: A Vision for K-12 Science Education |
| 7 | Become Familiar with the AzSS 3-Dimensions Structure | <ul style="list-style-type: none"> ⊕ AzSS 3-Dimensional Snapshot for Educators & Administrators |



**MAKE A FORCED
COPY**



To: Everyone ▾

done

Gray- means we will open and use

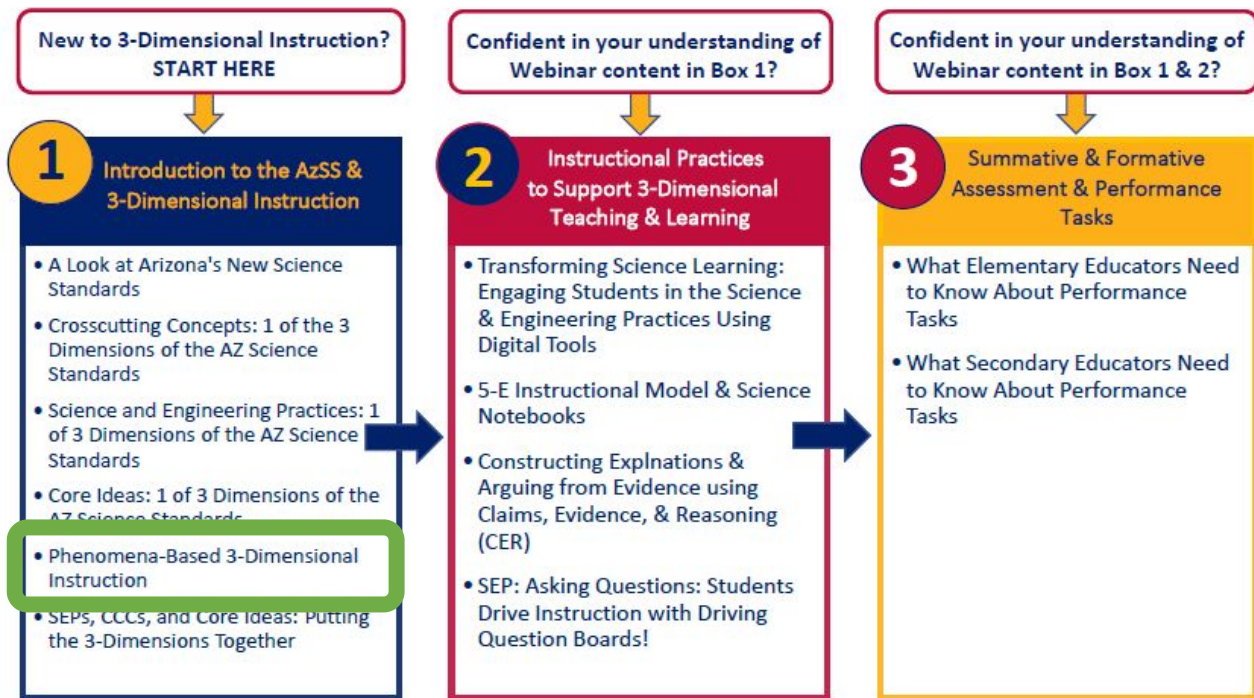


Webinar Pathways

ADE WEBINAR PATHWAYS FOR 3-DIMENSIONAL SCIENCE INSTRUCTION

Use this guide to determine which professional learning experiences will support your needs!

#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

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.



Access to Science Literacy for ALL Students

economically disadvantaged

English learners

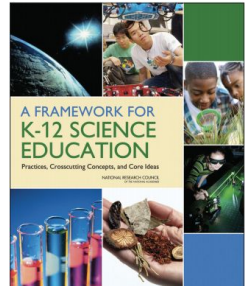
race and ethnicity



gifted and talented

students with disabilities

students with different cultures



2018 AZ Science Standards (AzSS) Comfort Level

Where do you fall on this spectrum?

A

B

C

D

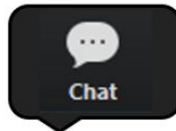
E



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

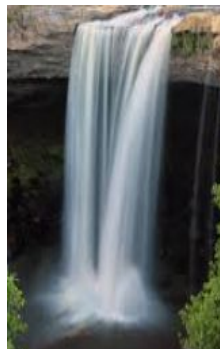
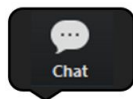
What would you see less of?

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



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.

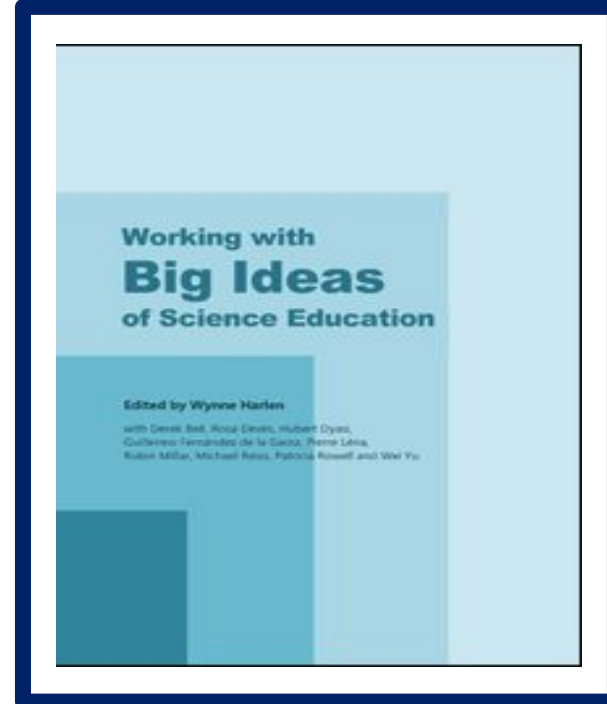
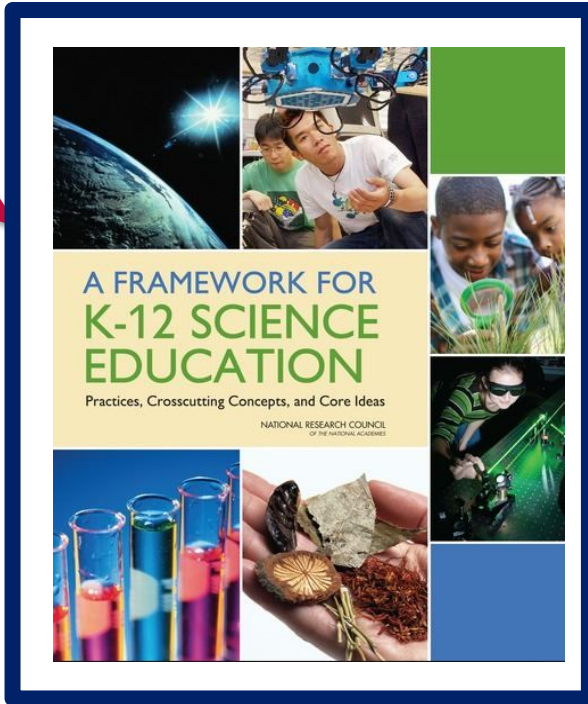
Figuring out...



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 Science Standards (AzSS) vs. Next Generation Science Standards (NGSS)

PART 1 of 2



Arizona Science Standards (AzSS) vs. Next Generation Science Standards (NGSS)

PART 2 of 2





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 resource could be used. An "NC" indicates that an NGSS resource 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- 1 st Grade Physical | | Next Generation Science Standards- 1 st 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?

A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas



3

Dimension 1 SCIENTIFIC AND ENGINEERING PRACTICES

From its inception, one of the principal goals of science education is to cultivate students' scientific habits of mind, develop their engagement in scientific inquiry, and teach them how to reason in context [1, 2]. There has always been a tension, however, between that should be placed on developing knowledge of the content and the emphasis placed on scientific practices. A narrow focus on the unfortunate consequence of leaving students with naive conceptions of the nature of scientific inquiry [3] and the impression that science is a collection of isolated facts [4].

This chapter stresses the importance of developing student understanding of how science and engineering achieve their ends while also strengthening their scientific practices. As previously noted, we use the term "practices" instead of a term such as "skills," to stress that engaging in science requires coordination both of knowledge and skill simultaneously.

In the chapter's three major sections, we first articulate what science and engineering practices are important for K-12 students. Then, we describe in detail eight practices we consider essential for learning science and engineering in grades K-12 (see box 3-1). Finally, we conclude that these practices support a better understanding of how scientific knowledge is produced and how engineering solutions are developed. Such an understanding helps students become more critical consumers of scientific information.

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A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas



4

Dimension 2 CROSSCUTTING CONCEPTS

Some important themes pervade science, mathematics, and technology and appear in one form or another, whether we are looking at an ancient civilization, the human body, or a modern society. They are ideas that transcend disciplinary boundaries and prove fruitful in explanation, in theory, in observation, and in design.

—American Association for the Advancement of Science

In this chapter, we describe concepts that bridge disciplinary boundaries and have explanatory value throughout much of science and engineering. These concepts were selected for their value across the sciences and in engineering. These concepts help provide students with an organizational framework for connecting knowledge from the various disciplines into a coherent and scientifically based view of the world.

Although crosscutting concepts are fundamental to an understanding of science and engineering, students have often been expected to build such knowledge without any explicit instructional support. Hence the purpose of highlighting as Dimension 2 of the framework is to elevate their role in the development of standards, curricula, instruction, and assessments. These concepts should be common and familiar touchstones across the disciplines and grade levels. Reference to the concepts, as well as their emergence in multiple disciplinary contexts, can help students develop a cumulative, coherent, and usable understanding of science and engineering.

Although we do not specify grade band endpoints for the crosscutting concepts, we do lay out a hypothetical progression for each. Like all learning

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A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas



A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas

A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas



7

Dimension 3 DISCIPLINARY CORE IDEAS—EARTH AND SPACE SCIENCES

Earth and space sciences (ESS) investigate processes that operate on Earth and also address its place in the solar system and the galaxy. Thus ESS involve phenomena that range in scale from the unimaginably large to the invisibly small.

Earth and space sciences have much in common with the other branches of science, but they also include a unique set of scientific pursuits. Inquiries into the physical sciences (e.g., forces, energy, gravity, magnetism) were pursued in part as a means of understanding the size, age, structure, composition, and behavior of Earth, the sun, and the moon; physics and chemistry later developed as separate disciplines. The life sciences likewise are partially rooted in earth science, as Earth remains the only example of a biologically active planet, and the fossils found in the geological record of rocks are of interest to both life scientists and earth scientists. As a result, the majority of research in ESS is interdisciplinary in nature and falls under the categories of astrophysics, geophysics, geochemistry, and geobiology. However, the underlying traditional discipline of geology, involving the identification, analysis, and mapping of rocks, remains a cornerstone of ESS.

Earth consists of a set of systems—atmosphere, hydrosphere, geosphere, and biosphere—that are intricately interconnected. These systems have differing sources of energy, and matter cycles within and among them in multiple ways and on various time scales. Small changes in one part of one system can have large and sudden consequences in parts of other systems, or they can have no effect at all. Understanding the different processes that cause Earth to change over time (in a sense, how it "works") therefore requires knowledge of the

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169



What are the 3 Dimensions?

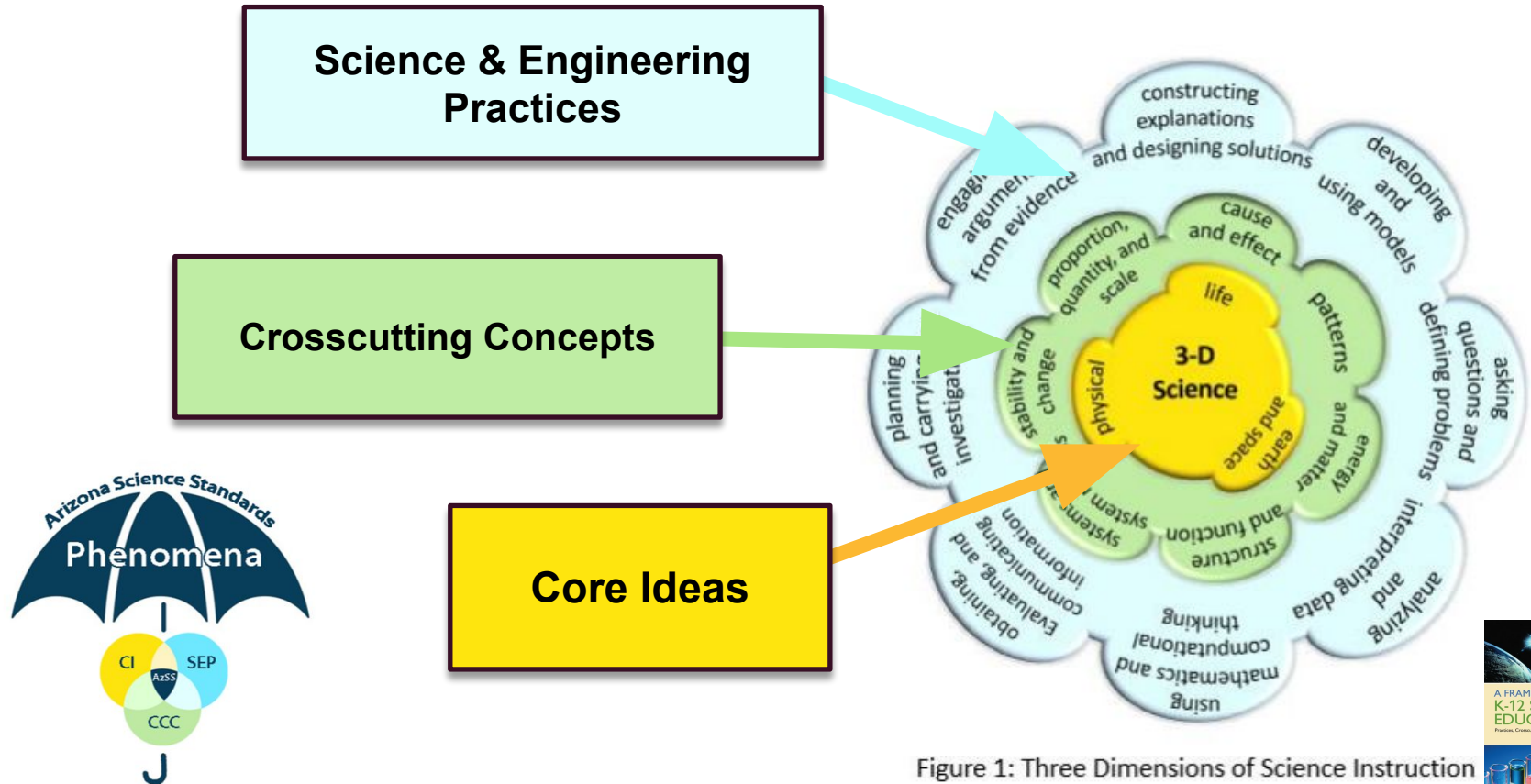
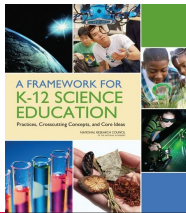
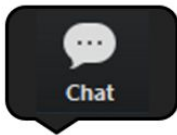
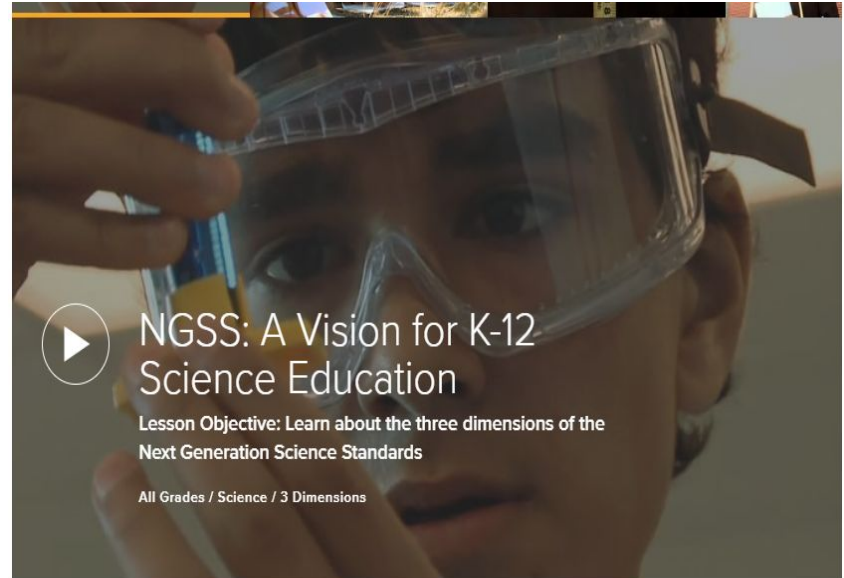


Figure 1: Three Dimensions of Science Instruction



What Is 3-Dimensional Science Instruction?



What examples of phenomena do you see in the video?

AzSS Snapshot: What You Should See Students “Doing,” “Thinking,” “Knowing,” and “Using” in Science

A Framework/Big Ideas for K-12 Science Instruction’s 3-Dimensions and AzSS Using Science

SEPs

Dimension 1: The Science and Engineering Practices

1. Asking questions and defining problems (p. 54)*
2. Developing and using models (p. 55)*
3. Planning and carrying out investigations (p. 59)*
4. Analyzing and interpreting data (p. 61)*
5. Using mathematics and computational thinking (p. 64)*
6. Constructing explanations and designing solutions (p. 67)*
7. Engaging in argument from evidence (p. 71)*
8. Obtaining, evaluating, and communicating information (p. 74)*

Dimension 2: The Crosscutting Concepts

1. Patterns (p. 85)*
2. Cause and effect (p. 87)*
3. Scale, proportion, and quantity (p. 90)*
4. Systems and system models (p. 94)*
5. Energy and matter (p. 96)*
6. Structure and function (p. 96)*
7. Stability and change (p. 98)*

CCCs

Dimension 3: The Core Ideas of Knowing Science and The Core Ideas of Using Science

The Core Ideas of Knowing Science

P: Physical Science (p. 105)*

P1: All matter in the Universe is made of very small particles. (p. 20)**

P2: Objects can affect other objects at a distance. (p. 21)**

P3: Changing the movement of an object requires a net force to be applied on it. (p. 22)**

P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event. (p. 23)**

E: Earth and Space Science (p. 171)*

E1: The composition of the Earth and its atmosphere and the natural human processes occurring within them shape the Earth's surface and climate. (p. 24)**

E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe. (p. 25)**

L: Life Science (p. 142)*

L1: Organisms are organized on a cellular basis and have a finite life span. (p. 26)**

L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms. (p. 27)**

L3: Genetic information is passed down from one generation of organisms to another. (p. 28)**

L4: The unity and diversity of organisms, living and extinct, is the result of evolution. (p. 29)*

The Core Ideas of Using Science

U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised. (p. 30 & 31)**

U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products. (p. 32)**

U3: Applications of science often have ethical, social, economic, and/or political implications. (p. 23)**

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.

Grade 2

Standard
number 4

2.E1U1.4

Standard
addresses core
ideas E1 and U1

Earth and Space Standards

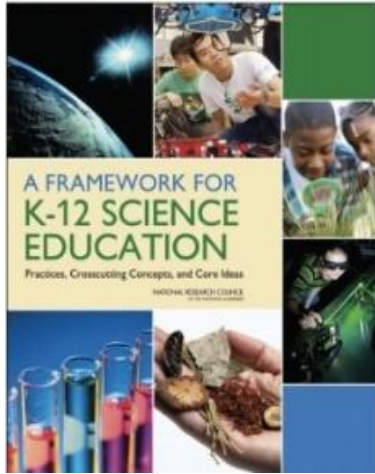
2.E1U1.1

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.

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



Arizona Science Standards
2018

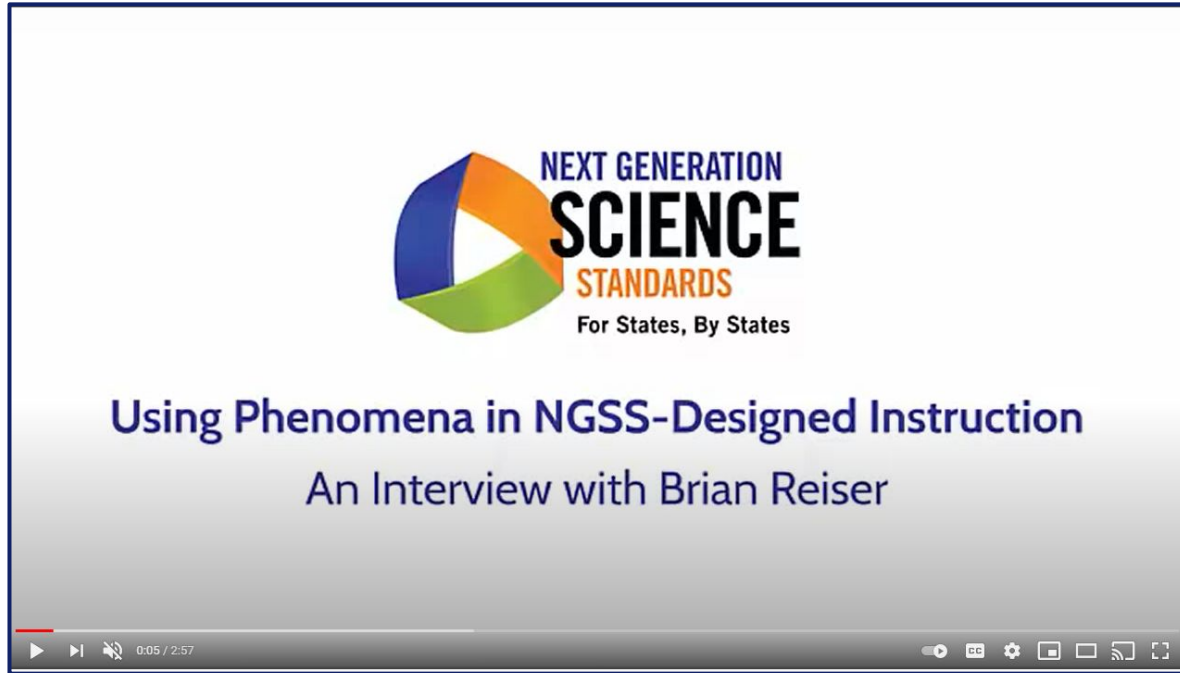
Arizona Department of Education
High Academic Standards for Students

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



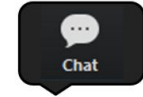
https://docs.google.com/document/d/1liDM8E_5O3EYYrO9pnu3f-yCHqC-byw1Anxym5pSCs/copy

Using Phenomena



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





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.

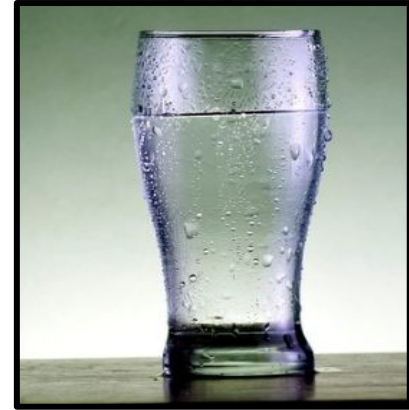


WHAT, HOW, WHY

- 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

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)

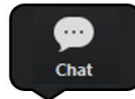
1) Watch the video clip.



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



youtube.com/watch?v=Zz95_VvTxZM



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.

#10 in Dashboard

...

Chat

To: Everyone ▾

ready

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

Notice & Wonder



youtube.com/watch?v=Zz95_VvTxZM

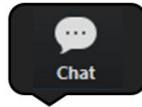
| I notice/see (observations) | I think (initial ideas/prior thinking) | I wonder (questions) |
|--------------------------------|---|-------------------------|
| | | |



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

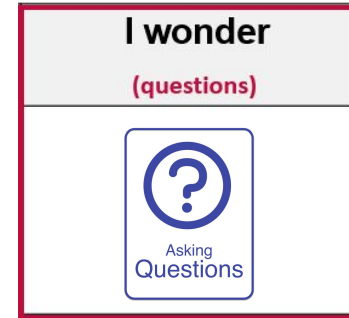
- Which observations did you share with others?
- Which observations were new to you?
- Add any new noticings to your S-T-W table



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

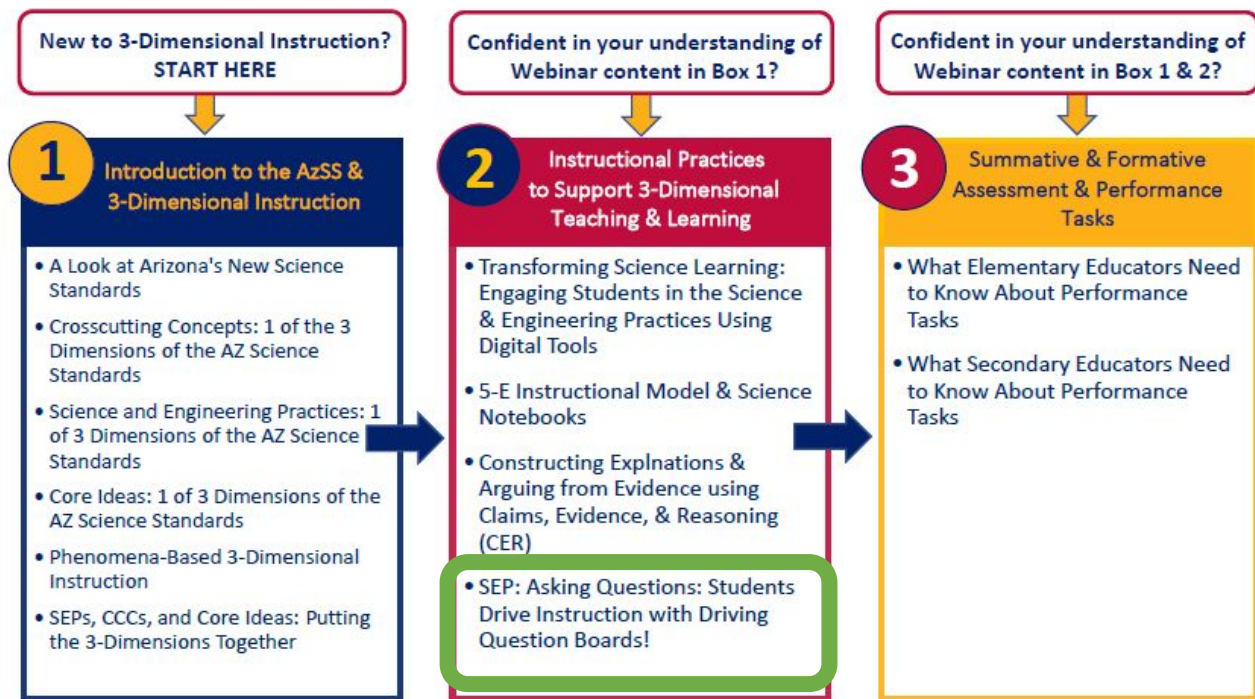
| | | |
|----|-----------------------------|--|
| 11 | Jamboards by Birthday Month | <div>⊕ Driving Question Board- July-December</div> <div>⊕ Driving Question Board- January-June</div> |
|----|-----------------------------|--|



Asking Questions/Driving Question Board Webinar

ADE WEBINAR PATHWAYS FOR 3-DIMENSIONAL SCIENCE INSTRUCTION

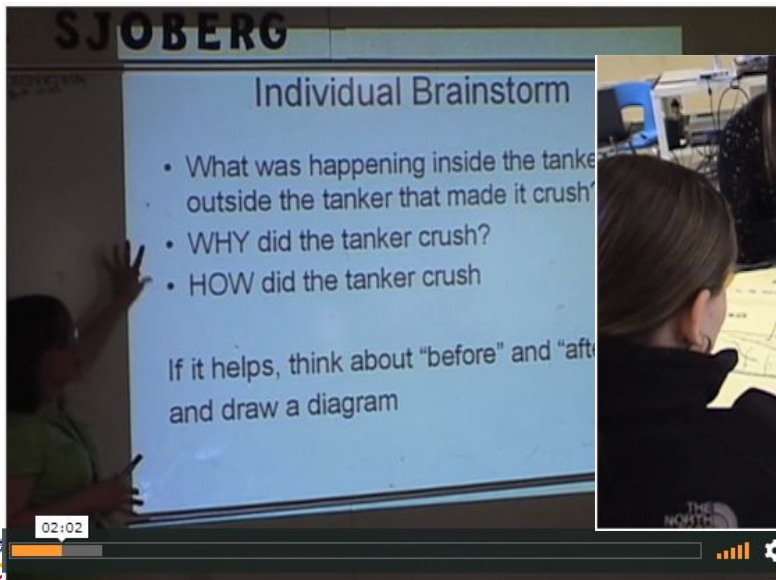
Use this guide to determine which professional learning experiences will support your needs!



If we were to continue this activity..

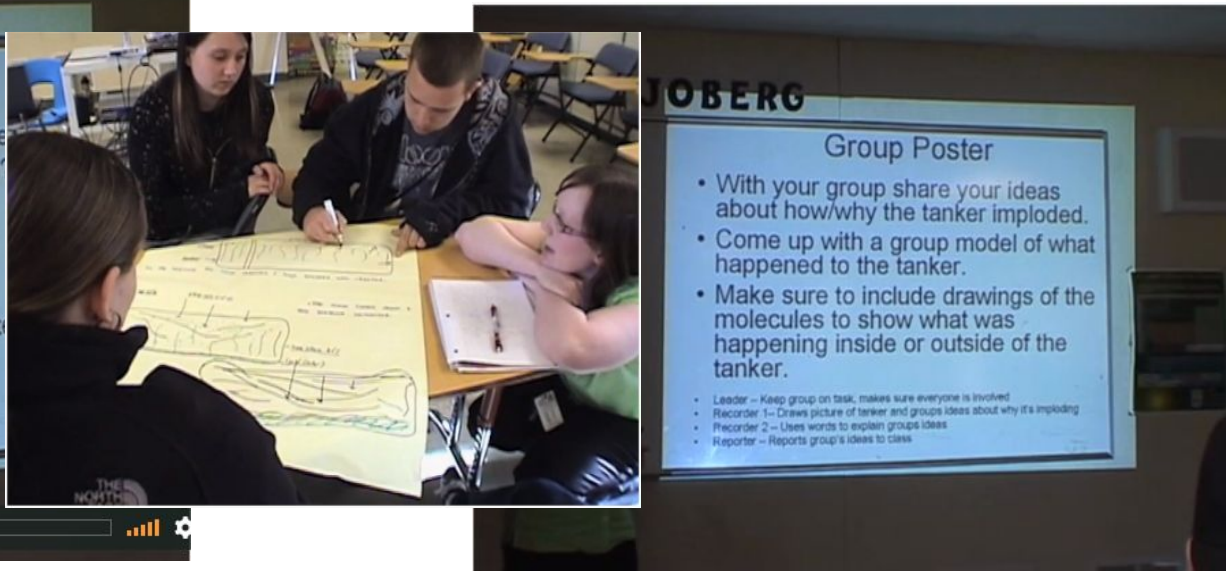
Students might...

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



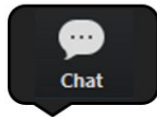
Debriefing the Launch

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

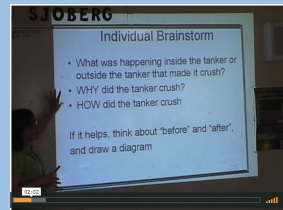
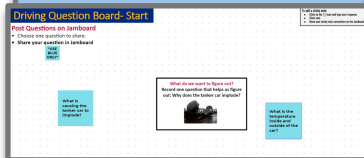
Phenomena

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



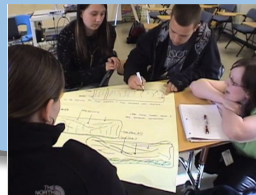
Question

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?

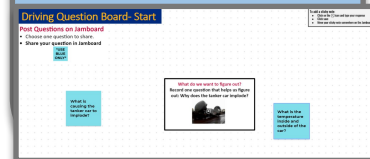


New Ideas

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?

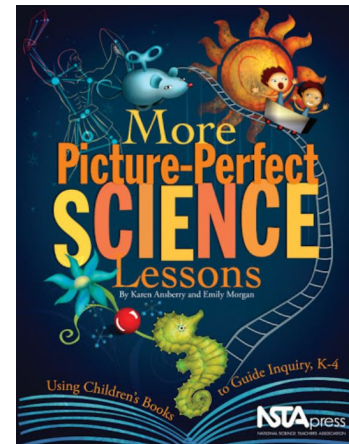
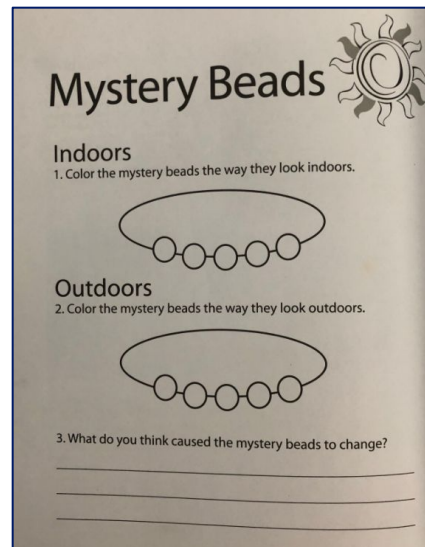


Design for Distance Learning

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



Elementary Experience- Mystery Beads



#2 in Dashboard- Mystery Beads- watch first!

Progressing towards----->

3.P.4U.1.3

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

Good Phenomena:

- ✓ Spark curiosity and wonder
- ✓ Address the standards(s)
- ✓ Can be investigated
- ✓ Aren't always phenomenal

HS-PS1-3: Electrical Forces and Bulk Scale Structure
Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to under the strength of electrical forces between particles. (Patterns)

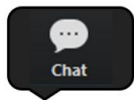


youtube.com/watch?v=3ps3Js-psgo

#12 in Dashboard



Shifts in



1. Read

2. Share one of the following:

- A-ha! Moment
- Quote
- Connection

PRIOR THINKING ABOUT PHENOMENA

If it's something fun, flashy, or involves hands-on activities, it must be engaging.

Anything students are interested in would make a good "engaging phenomenon"

Explanations (e.g., "electromagnetic radiation can damage cells") are examples of phenomena

Phenomena are just for the initial hook

Phenomena are good to bring in after students develop the science ideas so they can apply what they learned

Engaging phenomena need to be questions

Student engagement is a nice optional feature of instruction, but is not required

THINKING ABOUT PHENOMENA THROUGH THE AzSS

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.

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.

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 can drive the lesson learning, and reflection/monitoring throughout. Using phenomena in these ways leads to deeper learning.

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.

Phenomena are observable occurrences. Students need to *use the occurrence to help generate the science questions or design problems* that drive learning.

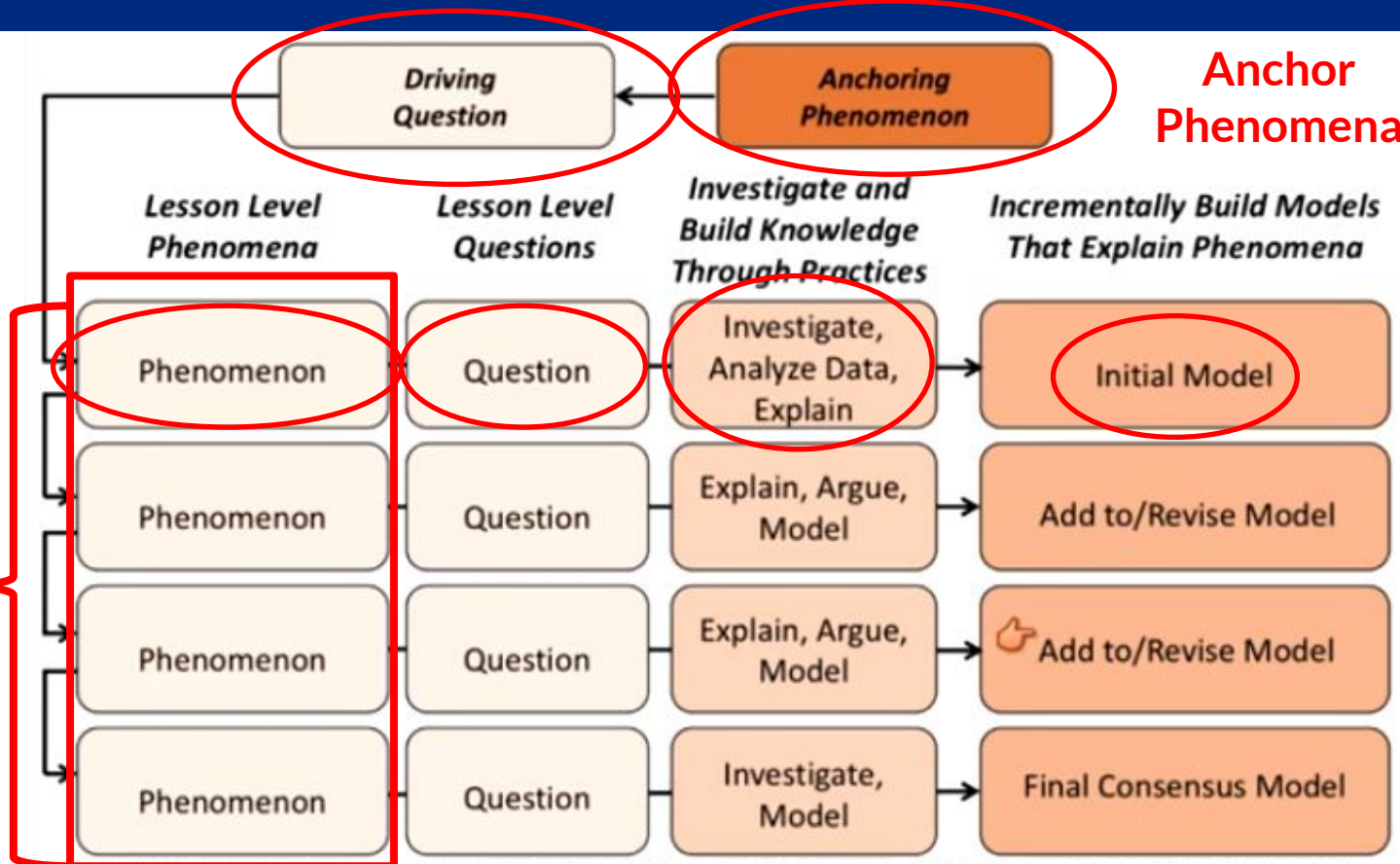
Engagement is a crucial access and equity issue. Students who do not have access to the material in a way that makes sense and is relevant to them are disadvantaged. Selecting phenomena that students find interesting, relevant, and consequential helps support their engagement. A good phenomenon builds on everyday or family experiences: who students are, what they do, where they came from.



Central Role of Phenomena

Investigative
Phenomena

Anchor
Phenomena



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:

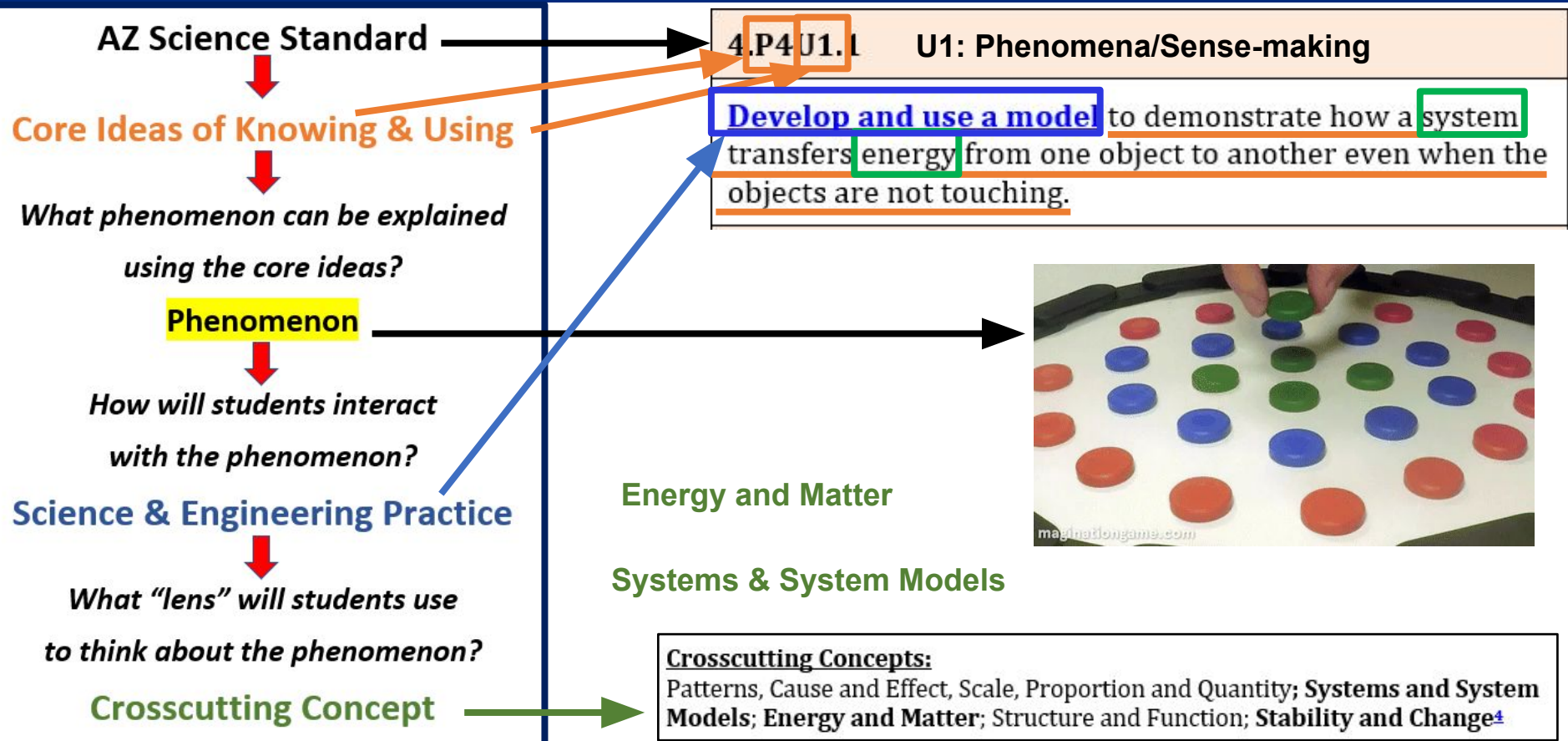
- ✓ Sparks curiosity and wonder- doesn't have to be “wow!,” but more likely is a “huh?” experience
- ✓ Can be investigated
- ✓ Address the standard(s)

Do not select a phenomenon if it:

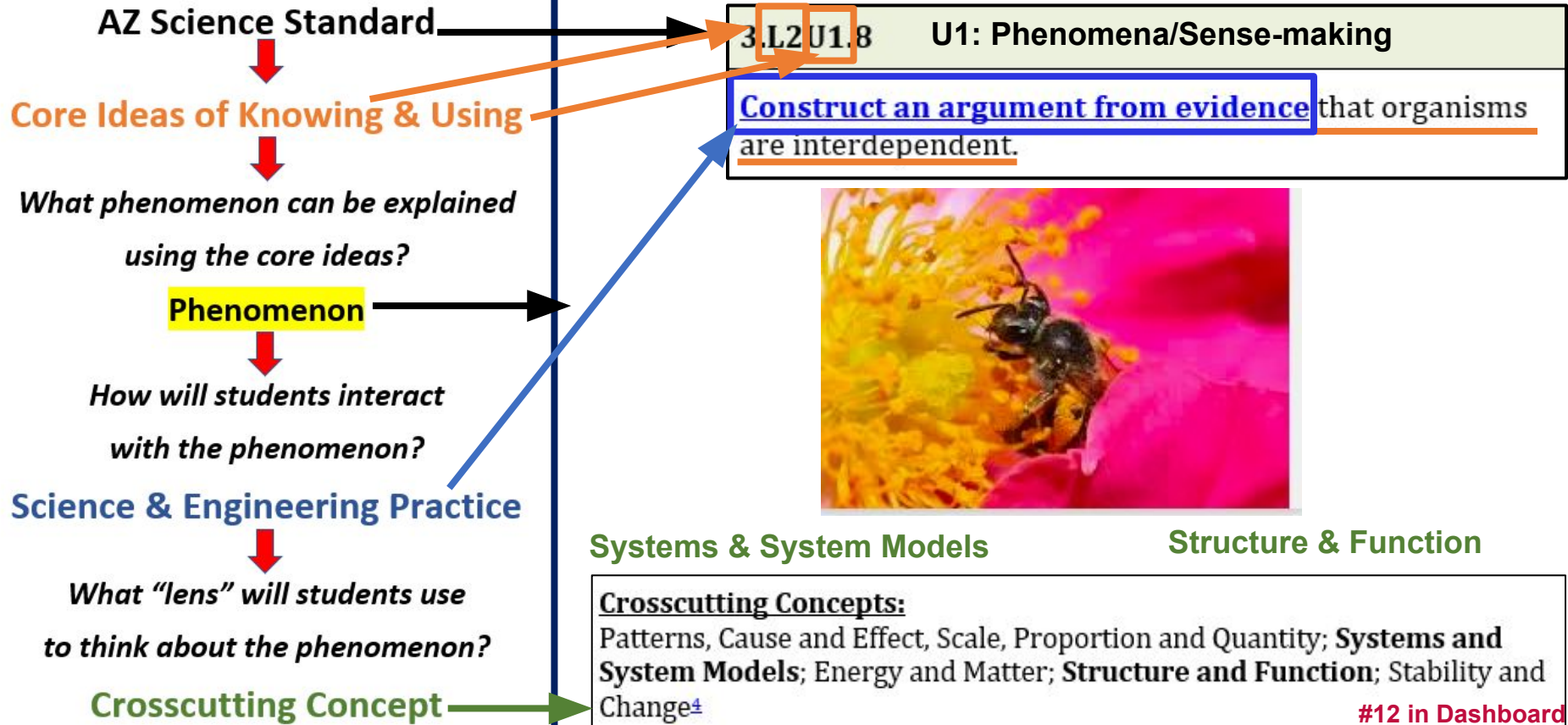
- Is peripheral to the subject content of the curriculum
- Does not surprise or generates little curiosity and the teacher has to do all the work
- Involves science concepts that are too difficult for students to grasp
- Is too complex for the students to solve, leading them to simply think of it as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



Designing Phenomena-Based Instruction



Designing Phenomena-Based Instruction



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- <i>Some lessons called "Daily Dos" are free, for full access membership is required</i> | ⊕ Daily Dos: NSTA Daily Dos Sensemaking Lessons |
| 17 | Arizona Science Teachers Association (ASTA) Middle School Science Units- FREE | ⊕ ASTA Middle 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/phenomena/ |
| 22 | Project SING Phenomena | ⊕ http://questlc.org/phenomena/ |

Teaching Science is Phenomenal

Using Phenomena to Engage Students in Three-Dimensional Science Performances Consistent with the NRC Framework and NGSS



Organizing Student Science Performances Using
5E and Gather, Reason, Communicate
Instructional Sequences

Brett D. Moulding & Rodger W. Bybee

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 | Rebecca.Garelli@azed.gov

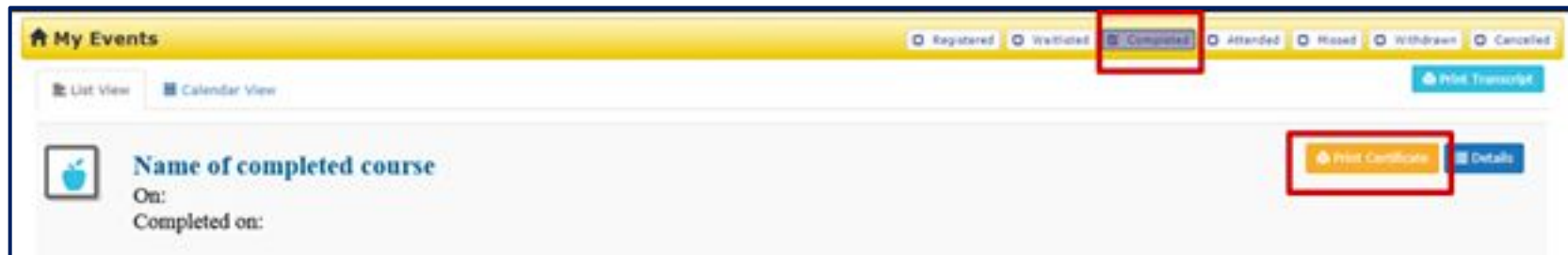


REMINDER!

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
- 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