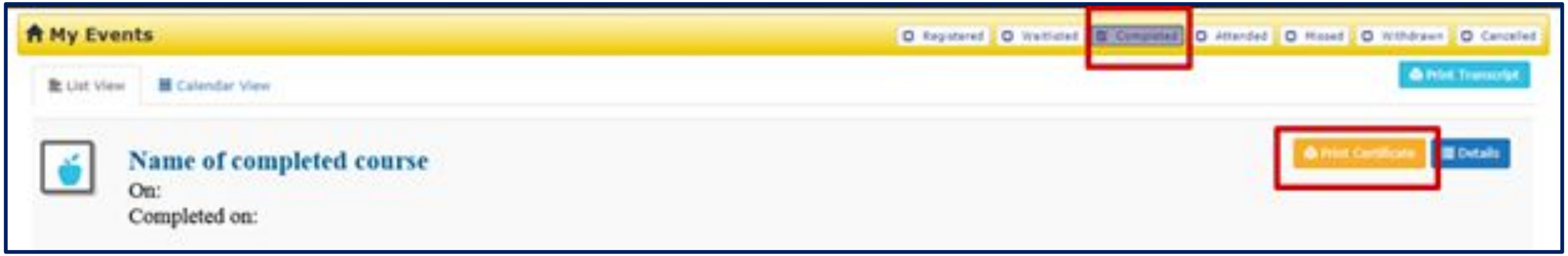
WELCOME!

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

Arizona Department of Education

A Look at Arizona's Science Standards

Rebecca Garelli
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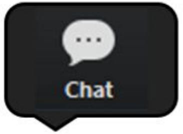
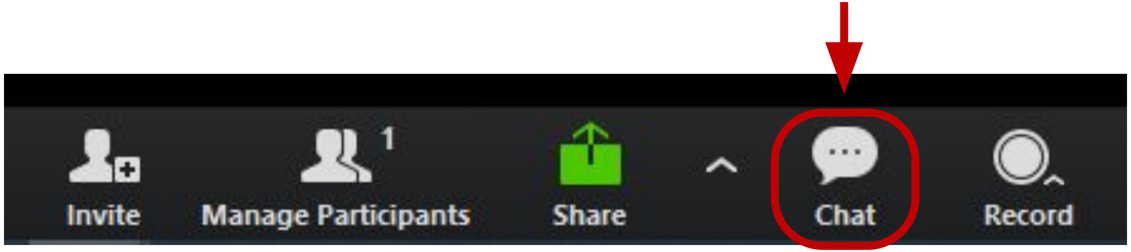
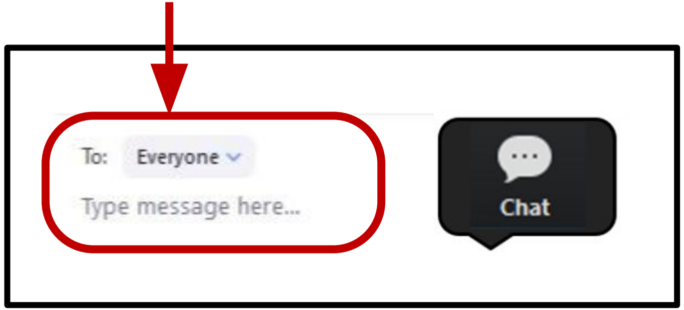
Welcome!

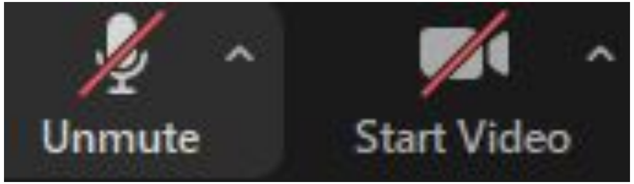


- Name
- Current Position
- County

Webinar Housekeeping







Webinar Resource Dashboard

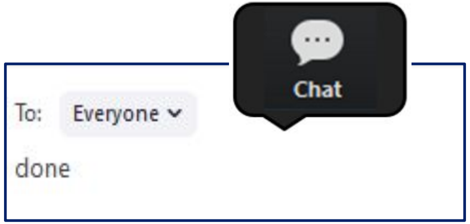
A Look at Arizona's New Science Standards- Webinar Dashboard for 2.18.21

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

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

1	General Resources	⊕ Presentation PDF: PDF of Slides ⊕ ADE Webinar Pathways
2	AzSS Implementation Timeline	⊕ Implementation Timeline- Updated
3	AzSCI Assessment Website- links to Resource Suite & Sample Items/Test	⊕ AzSCI Assessment Website
4	Shifts in Instruction- More of/Less of	⊕ New Vision for Science Education 1-Pager on Shifts
5	Jamboards by Birthday Monday	⊕ Jan_Feb_Mar_Apr Jam ⊕ May_June_July_Aug Jam ⊕ Sept_Oct_Nov_Dec Jam
6	Research Used to Develop the 2018 Arizona Science Standards	⊕ PDF Version of the K-12 Framework for Science Education ⊕ PDF Version of Working with Big Ideas of Science Education

MAKE A FORCED COPY



Gray- means we will open and use

Webinar Pathways

#1 in Dashboard

ADE WEBINAR PATHWAYS FOR 3-DIMENSIONAL SCIENCE INSTRUCTION

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

New to 3-Dimensional Instruction? START HERE

1 Introduction to the AzSS & 3-Dimensional Instruction

- A Look at Arizona's New Science Standards
- Crosscutting Concepts: 1 of the 3 Dimensions of the AZ Science Standards
- Science and Engineering Practices: 1 of 3 Dimensions of the AZ Science Standards
- Core Ideas: 1 of 3 Dimensions of the AZ Science Standards
- Phenomena-Based 3-Dimensional Instruction

Confident in your understanding of Webinar content in Box 1?

2 Instructional Practices to Support 3-Dimensional Teaching & Learning

- Transforming Science Learning: Engaging Students in the Science & Engineering Practices Using Digital Tools
- 5-E Instructional Model & Science Notebooks
- Constructing Explnations & Arguing from Evidence using Claims, Evidence, & Reasoning (CER)
- SEP: Asking Questions: Students Drive Instruction with Driving Question Boards!

Confident in your understanding of Webinar content in Box 1 & 2?

3 Summative & Formative Assessment & Performance Tasks

- What Elementary Educators Need to Know About Performance Tasks
- What Secondary Educators Need to Know About Performance Tasks

Link to Register for Live Science & STEM Webinars | Link to All Recorded Webinars

ADE Announcements

PAEMST 7-12 Awards

The Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST) are the nation's highest honors for teachers of mathematics and science (including computer science). Nominations and applications open for mathematics and science teacher grades 7-12 opened in the Fall. To submit a nomination, you only need the teacher's contact information. If you know more than one teacher deserving this award, you may submit more than one nomination. Teachers may also initiate the application process themselves at www.paemst.org.

Nominations close on **March 1, 2021**.

WHAT, HOW, WHY

GOALS:

- Discuss the implementation timeline of the 2018 Standards.
- Explain the instructional shifts represented by Arizona's 2018 Science Standards.
- Define and deepen understanding of 3-Dimensional science instruction, phenomena, and sensemaking.

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

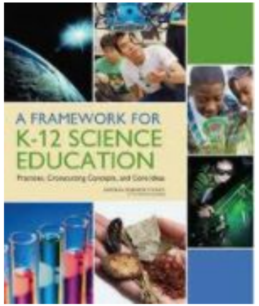
economically disadvantaged

English learners

race and ethnicity

gifted and talented

students with disabilities

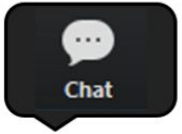


students with different cultures

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

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

Standards Implementation Timeline

New Standards Fall 2018	Year 1: 2019-2020 AIMS Science Assessment and begin implementation of new standards	Year 2: 2020-2021 Implementation year for standards and transition year for assessment	Year 3: 2021-2022 Implementation year for standards and assessment
2018-19: • 2004 Standards • AIMS Science spring 2019	• Implementation of new 2018 Standards • AIMS Science spring 2020 • Field Test for item types • Request waiver from USDOE for forms field test for 2021	• Continue implementing 2018 Standards • ~~AIMS Science spring 2021~~ • Forms Field Testing	New Science Assessment: 5th grade: 3/4/5 8th grade: 6/7/8 11th Grade 9/10/11 Essential Standards

ADE: Provides Phase 1 of guidance implementation
with documents and introductory webinars as professional development
(January- April, 2019)

Updated 8/24/20

- Please note the timeline for implementation of the new science standards and science assessment is tentative. As the implementation process evolves, ADE will solicit input from various stakeholders and share information regarding updates as necessary.

AzSCI
ARIZONA SCIENCE TEST

#2 and #3 in Dashboard

Instructional Shifts

What would you see less of?

What would you see more of?

Alone Zone

Read & Think: What are 3-5 items that resonate with you?

A New Vision for Science Education

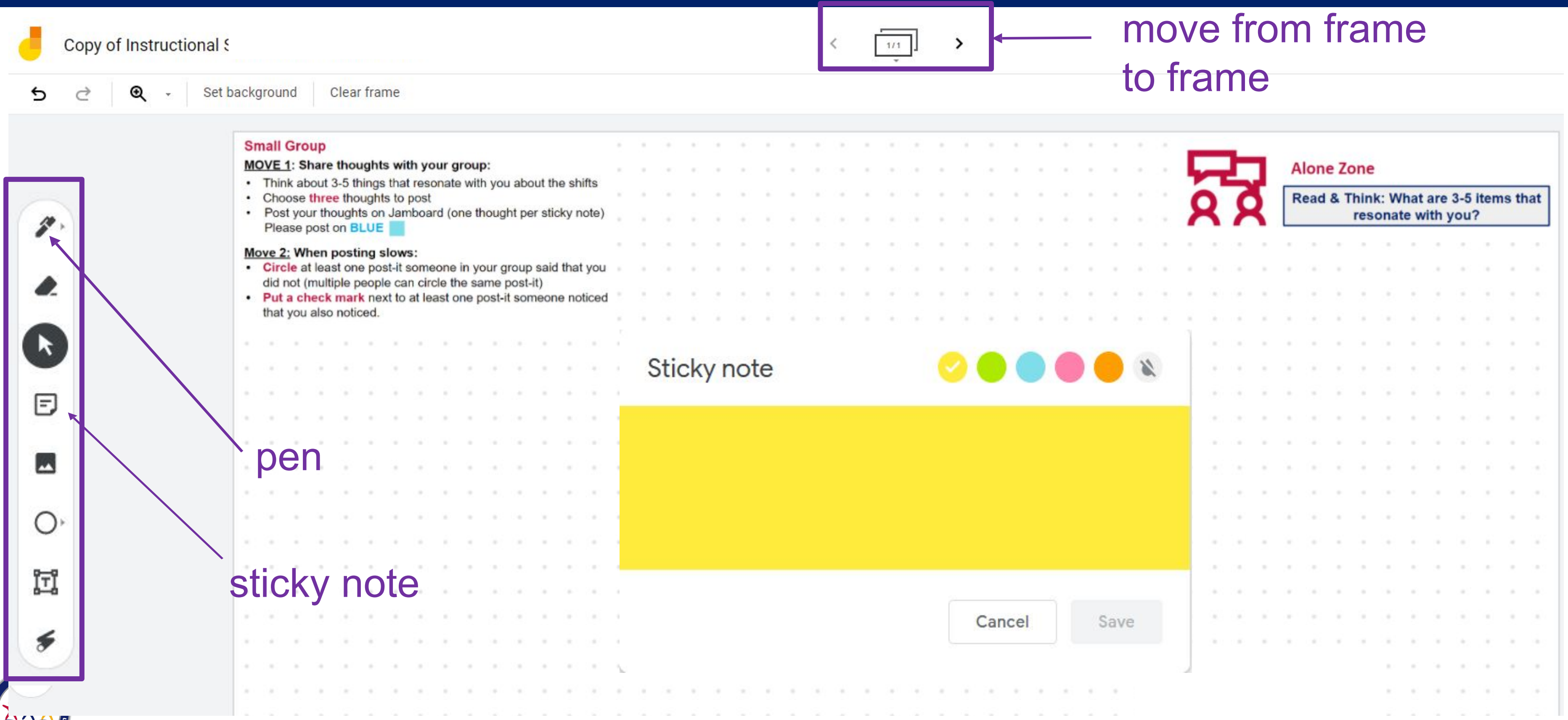
Implications of the Vision of the Framework for K-12 Science Education and the Arizona Science Standards

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

#4 in Dashboard

Using Jamboard



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

Jamboard Moves

Small Group

<u>MOVE 1</u>: Share thoughts with your group:

- Think about 3-5 things that resonate with you about the shifts
- Choose **three** thoughts to post
- Post your thoughts on Jamboard (one thought per sticky note) Please post on **BLUE**

<u>Move 2:</u> When posting slows:

- **Circle** at least one post-it someone in your group said that you did not (multiple people can circle the same post-it)
- **Put a check mark** next to at least one post-it someone noticed that you also noticed.

A New Vision for Science Education

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Jamboard (use your birthday month)

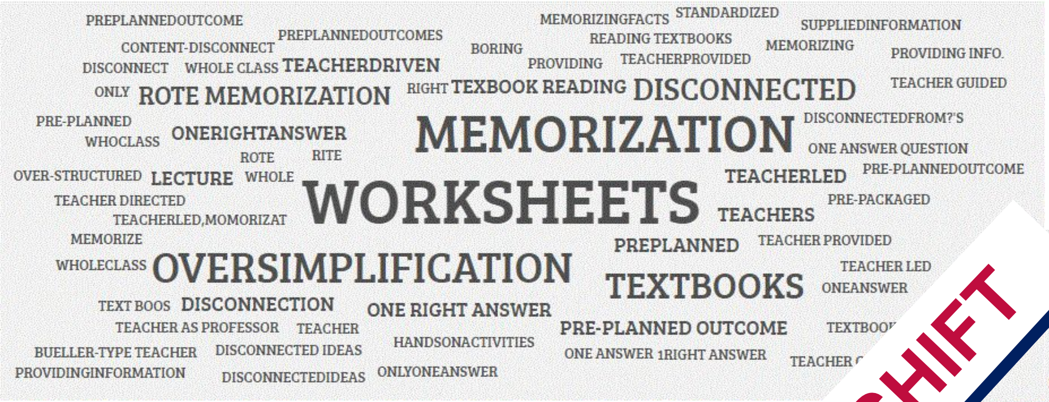
#5 in Dashboard

5	Jamboards by Birthday Monday	⊕ Jan_Feb_Mar_Apr Jam ⊕ May_June_July_Aug Jam ⊕ Sept_Oct_Nov_Dec Jam

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

Less of this….. More of this…..

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



In a science classroom you would see **more** of…..

FIGURING OUT

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

How Does It All Work?

Standards

What a student needs to know, understand, and be able to do by the end of each grade. Standards build across grade levels in a progression of increasing understanding and through a range of cognitive demand levels. Standards are adopted at the state level by the State Board of Education.

Curriculum

The resources used for teaching and learning the standards. Curricula are adopted at a local level by districts and schools.

Instruction

The methods used by teachers to teach their students. Instructional techniques are employed by individual teachers in response to the needs of the students in their classes to help them progress through the curriculum in order to master the standards.

Chat

Try to explain the difference in 9 words or less.

Standards Versus Performance Objectives

Content Standards

Standards are what students need to know, understand, and be able to do by the end of each grade level. Standards build across grade levels in a progression of increasing understanding and through a range of cognitive demand levels.

Performance Objectives

Performance Objectives are incremental steps toward mastery of individual content standards. Performance Objectives are knowledge and skills that a student must demonstrate at each grade level. Performance objectives do not imply a progression of learning and, because they are discrete skills, reach a limited level of cognitive demand.

Standards	Performance Objectives
Broad and overarching	Small scope
Higher depth of knowledge	Lower depth of knowledge
Open-ended questions	Teacher-generated questions
Evidence-based, connected answers	Limited Answers
Deep and connected learning	Shallow knowledge
Reoccurring	One-and-done
Spiral	Linear
Multiple opportunities for assessment	Single opportunity for assessment

Chat

What stands out to you as a big difference between a standard and a performance objective?

2004 Science Standards vs. 2018 Standards

Concept 3: Energy and Magnetism Investigate different forms of energy.
PO 1. Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects.
PO 2. Construct series and parallel electric circuits.
PO 3. Explain the purpose of conductors and insulators in various practical applications.
PO 4. Investigate the characteristics of magnets (e.g., opposite poles attract, like poles repel, the force between two magnet poles depends on the distance between them).
PO 5. State cause and effect relationships between magnets and circuitry.

Physical Science Standards
4.P4U1.1
Develop and use a model to demonstrate how a system transfers energy from one object to another even when the objects are not touching.
4.P4U1.2
Develop and use a model that explains how energy is moved from place to place through electric currents.
4.P2U1.3
Develop and use a model to demonstrate magnetic forces.
4.P4U3.4
Engage in argument from evidence on the use and impact of renewable and nonrenewable resources to generate electricity.

WHAT, HOW, WHY

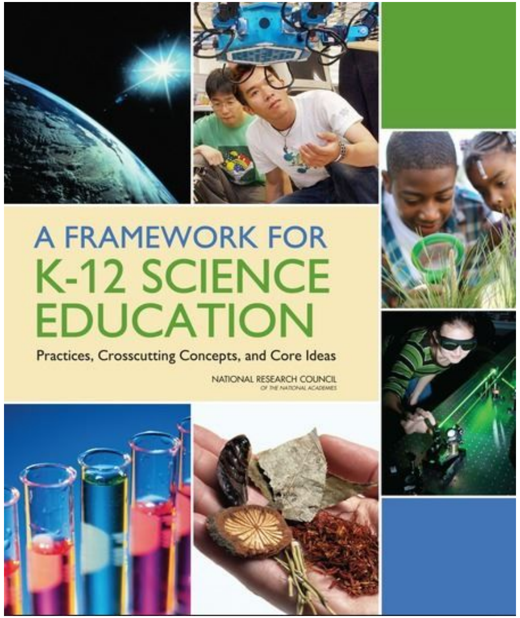
GOALS:

- Discuss the implementation timeline of the 2018 Standards.
- Explain the instructional shifts represented by Arizona's 2018 Science Standards.
- Define and deepen understanding of 3-Dimensional science instruction, phenomena, and sensemaking.

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

NGSS

AzSS



AzSS

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

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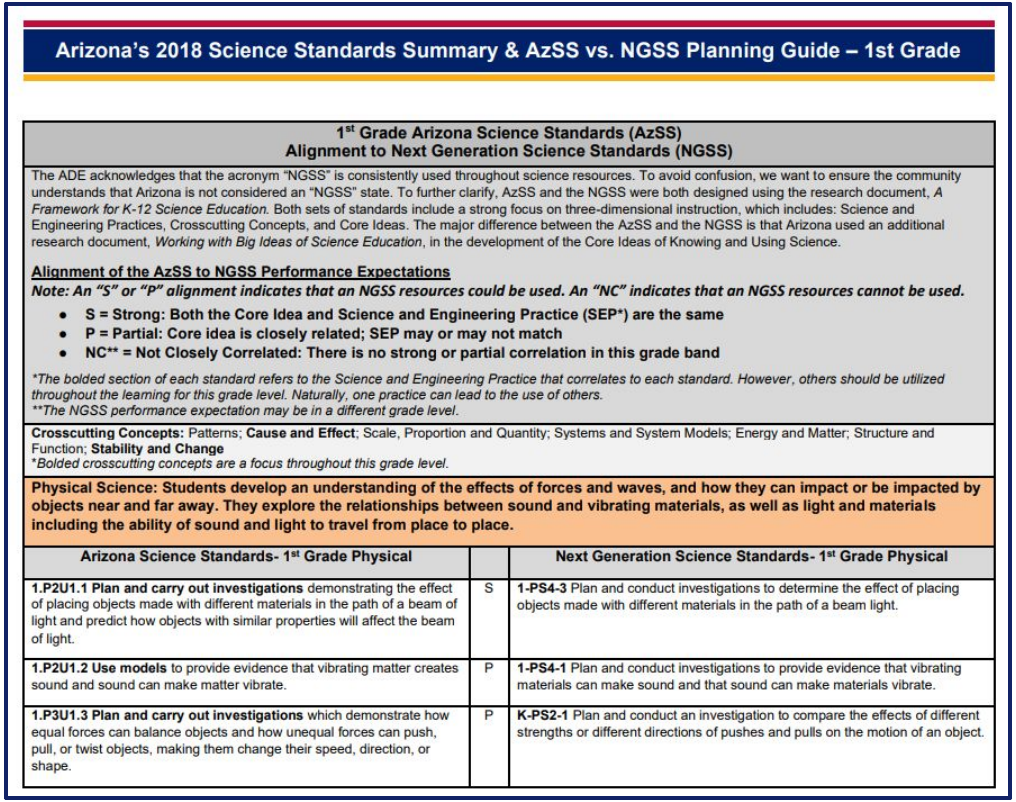
Resources in Dashboard

#5 in Dashboard



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.

#7 and #8 in 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 PRA

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

This chapter stresses the importance of developing student how science and engineering achieve their ends while also streng petency with related practices. As previously noted, we use the t instead of a term such as "skills," to stress that engaging in scien requires coordination both of knowledge and skill simultaneousl

In the chapter's three major sections, we first articulate wh science and engineering practices is important for K-12 students practices should reflect those of professional scientists and engin describe in detail eight practices we consider essential for learnin engineering in grades K-12 (see Box 3-1). Finally, we conclude th in these practices supports a better understanding of how scienti produced and how engineering solutions are developed. Such un help students become more critical consumers of scientific inform

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 ov and over again, whether we are looking at an ancient civilization, the human body, o comet. They are ideas that transcend disciplinary boundaries and prove fruitful in exp nation, in theory, in observation, and in design.
—American Association for the Advancement of Scienc

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

Although crosscutting concepts are fundamental to an understandin ence and engineering, students have often been expected to build such kn without any explicit instructional support. Hence the purpose of highligh as Dimension 2 of the framework is to elevate their role in the developme standards, curricula, instruction, and assessments. These concepts should common and familiar touchstones across the disciplines and grade levels. reference to the concepts, as well as their emergence in multiple disciplin texts, can help students develop a cumulative, coherent, and usable under of science and engineering.

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

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

5

Dimension 3
DISCIPLINARY CORE IDEAS—
PHYSICAL SCIENCES

Most systems or processes depend at some level on physical and chemical subprocesses that occur within it, whether the system in question is a star, Earth's atmosphere, a river, a bicycle, the human brain, or a living cell. Large-scale systems often have emergent properties that cannot be explained on the basis of atomic-scale processes; nevertheless, to understand the physical and chemical basis of a system, one must ultimately consider the structure of matter at the atomic and subatomic scales to discover how it influences the system's larger scale structures, properties, and functions. Similarly, understanding a process at any scale requires awareness of the interactions occurring—in terms of the forces between objects, the related energy transfers, and their consequences. In this way, the physical sciences—physics and chemistry—underlie all natural and human-created phenomena, although other kinds of information transfers, such as those facilitated by the genetic code or communicated between organisms, may also be critical to understanding their behavior. An overarching goal for learning in the physical sciences, therefore, is to help students see that there are mechanisms of cause and effect in all systems and processes that can be understood through a common set of physical and chemical principles.

The committee developed four core ideas in the physical sciences—three of which parallel those identified in previous documents, including the *National Science Education Standards* and *Benchmarks for Science Literacy* [1, 2]. The three core ideas are PS1: Matter and Its Interactions, PS2: Motion and Stability: Forces and Interactions, and PS3: Energy.

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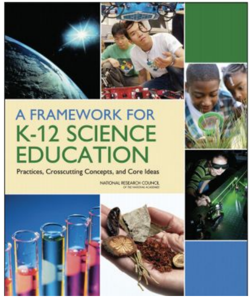


What are the 3 dimensions?

Science & Engineering Practices

Crosscutting Concepts

Core Ideas

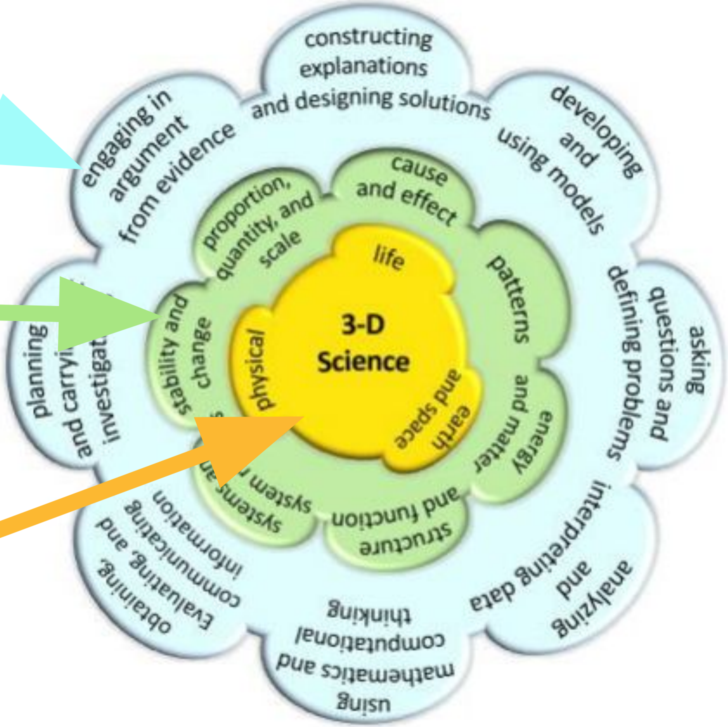


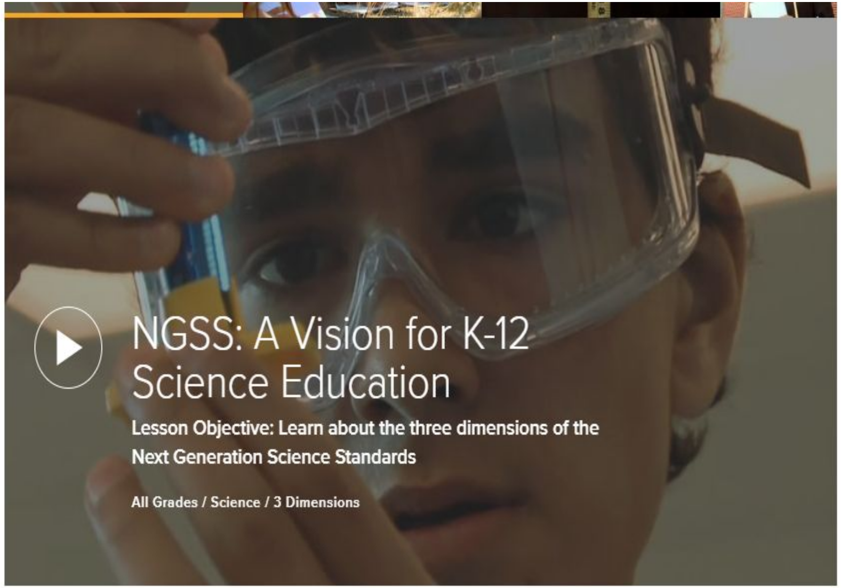
Figure 1: Three Dimensions of Science Instruction

What Is 3-Dimensional Science Instruction?

How do the Arizona Science Standards represent a shift in science education?

What do the teachers in this video learn from engaging with 3-dimensional science instruction?

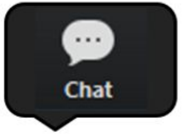
How do the three dimensions work together?



#9 in Dashboard

Waterfall Chat

- How do the Arizona Science Standards represent a shift in science education?
- What do the teachers in this video learn from engaging with 3-dimensional science instruction?
- How do the three dimensions work together?



Choose one question to answer- 1 minute to write.

Write in the chat box, BUT DO NOT HIT ENTER!

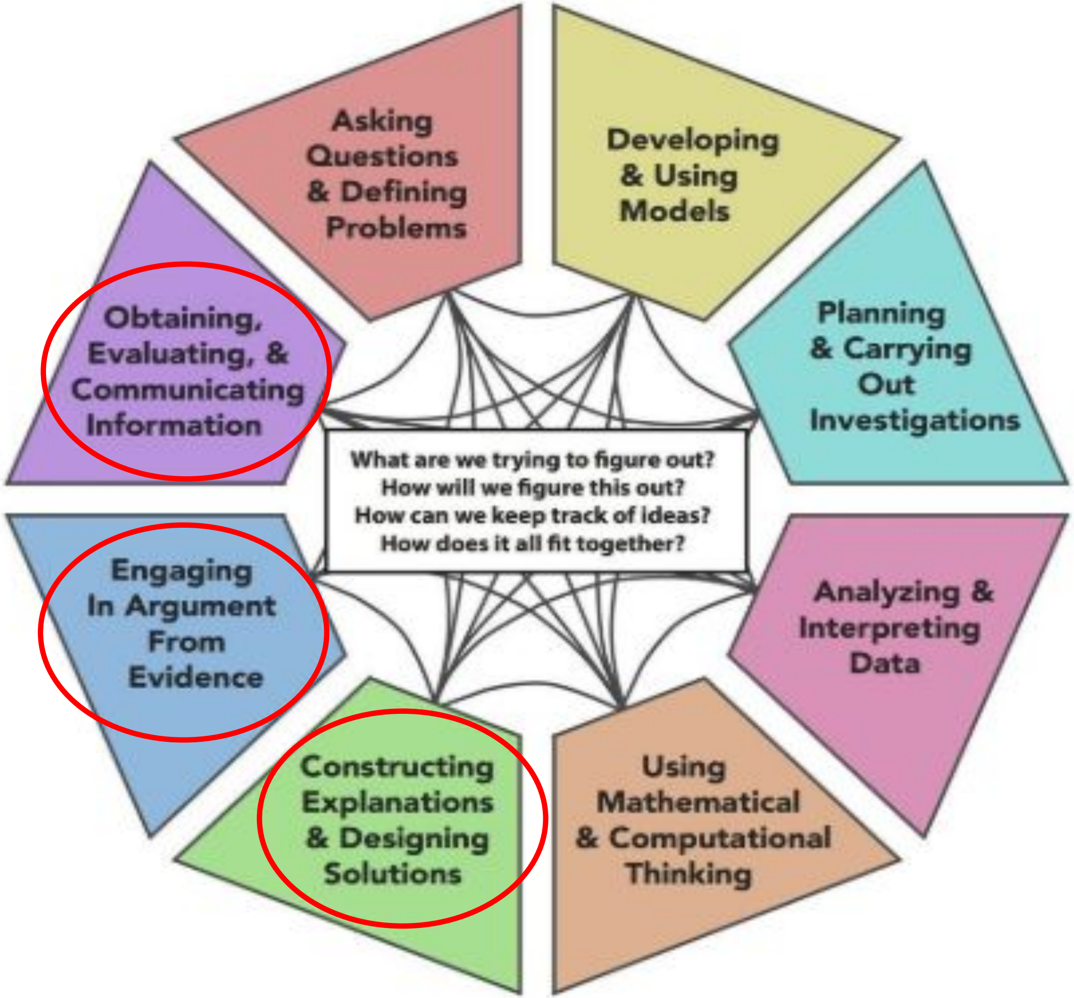
Wait for countdown..3..2..1

Science and Engineering Practices

Dimension 1
What we do

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

National Research Council. (2012). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press



Schwarz, C. V., Passmore, C. M., & Reiser, B. J. (2017). Moving beyond "knowing" science to making sense of the world. In C. V. Schwarz, C. M. Passmore & B. J. Reiser (Eds.), *Helping students make sense of the world through next generation science and engineering practices* (pp. 3-21). Arlington, VA: NSTA Press.

Grouping the Practices

#10 in Dashboard

3 Categories of Science & Engineering Practices

Investigating Practices

1. Asking Questions

3. Planning & Carrying Out Investigations

5. Using Mathematical & Computational Thinking

Sensemaking Practices

2. Developing & Using Models

4. Analyzing & Interpreting Data

6. Constructing Explanations

Critiquing Practices

7. Engaging in Argument from Evidence

8. Obtaining, Evaluating, & Communicating Information

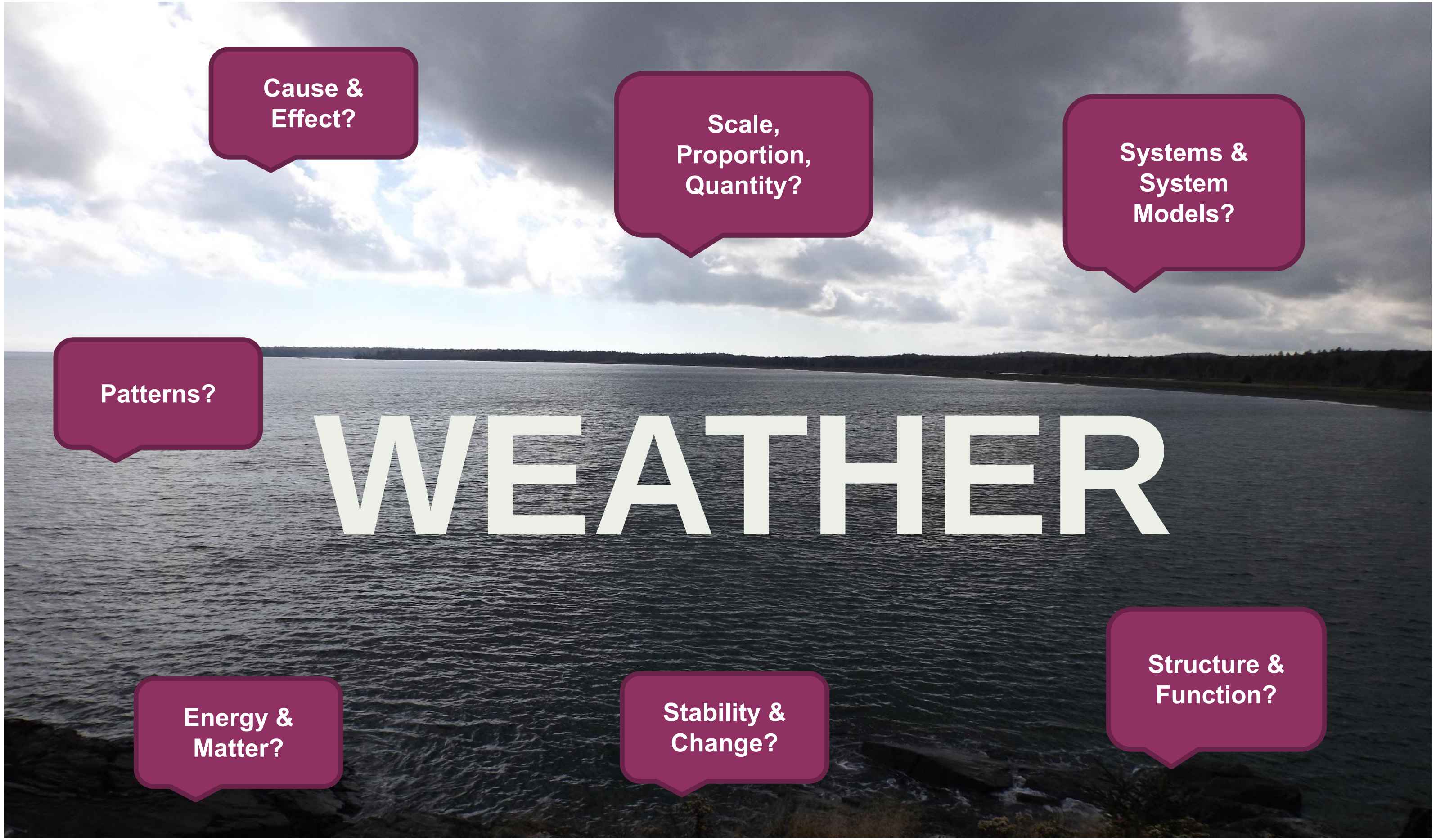
Article- #10 in Dashboard

Crosscutting Concepts

Dimension 2
How we think

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

National Research Council. (2012). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press


Cause & Effect?
Scale, Proportion, Quantity?
Systems & System Models?
Patterns?
WEATHER
Energy & Matter?
Stability & Change?
Structure & Function?

Dimension 3: Core Ideas for Knowing Science

What We KNOW

Physical Science

- P1: All matter in the Universe is made of very small particles.
- P2: Objects can affect other objects at a distance.
- P3: Changing the movement of an object requires a net force to be acting on it.
- 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.

Earth and Space

- E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.
- E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.

Life Science

- L1: Organisms are organized on a cellular basis and have a finite life span.
- L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.
- L3: Genetic information is passed down from one generation of organisms to another.
- L4: The unity and diversity of organisms, living and extinct, is the result of evolution.

*Adapted from *Working with Big Ideas in Science Education*

Distribution of Core Ideas of Knowing Science

Knowing Science	Knowing Science	K	1	2	3	4	5	6	7	8	HS
P1 Physical Science	All matter in the Universe is made of very small particles.										
P2: Physical Science	Objects can affect other objects at a distance.										
P3: Physical Science	Changing the movement of an object requires a net force to be acting on it.										
P4: Physical Science	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.										

Knowing Science	Knowing Science	K	1	2	3	4	5	6	7	8	HS
E1 Earth & Space Science	E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.										
E2: Earth & Space Science	E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.										

Knowing Science	Knowing Science	K	1	2	3	4	5	6	7	8	HS
L1 Life Science	Organisms are organized on a cellular basis and have a finite life span.										
L2: Life Science	Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.										
L3: Life Science	Genetic information is passed down from one generation of organisms to another.										
L4: Life Science	The unity and diversity of organisms, living and extinct, is the result of evolution.										

Dimension 3: Core Ideas for Using Science

How we USE

- 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.

- U2 The knowledge produced by science is used in engineering and technologies to solve problems and/or create products.

- U3 Applications of science often have both positive and negative ethical, social, economic, and/or political implications.

*Adapted from *Working with Big Ideas in Science Education*

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

CCCs

1

Dimension 1: The Science and Engineering Practices

DO

1. Asking questions and defining pr s (p. 54)*
2. Developing and using mode s
3. Planning and carrying out investig s (p. 59)*
4. Analyzing and interpreting data (p *
5. Using mathematics and computati 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)*

2

Dimension 2: The Crosscutting Concepts

THINK

1. Patterns (p. 85)*
2. Cause and effect (p. 87)*
3. Scale, proportion, and quantity *
4. Systems and system model 1)*
5. Energy and matter (p. 9
6. Structure and function (p. 96)*
7. Stability and change (p. 98)*

The core ideas of Knowing science (CIs)

Arizona Science Standards unique Using Science (CIs)

3

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

The Core Ideas of Knowing Science

KNOW

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 ac 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 and human processes occurring within them shape the Earth's surface a climate. (p. 24)**
E2: The Earth and our solar system are a very small part of one of ma 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

USE

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)**

#12 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.

Grade 2

Standard number 4

2.E1U1. 4

Standard addresses core ideas E1 and U1

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

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

DO

Dimension 1: The Science and Engineering Practices

1. Asking questions and defining problems (p. 54)*
2. Developing and using models (p. 56)*
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)*

THINK

Dimension 2: The Crosscutting Concepts

1. Patterns (p. 85)*
2. Cause and effect (p. 87)*
3. Scale, proportion, and quantity (p. 89)*
4. Systems and system models (p. 91)*
5. Energy and matter (p. 94)*
6. Structure and function (p. 96)*
7. Stability and change (p. 98)*

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

KNOW

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)**
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USE

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)**

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

*A Framework for K-12 Science Education **Working with Big Ideas of Science Education Updated: 3/4/20

Grade 2

Standard number 4

2.E1U1. 4

Standard addresses core ideas E1 and U1

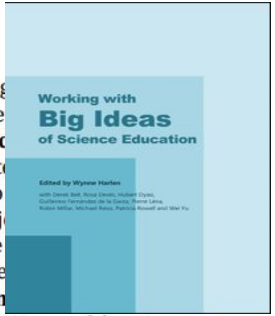
2.E1U1.4. Observe, describe, and predict how wind and water change the shape of the land resulting in a variety of landforms.

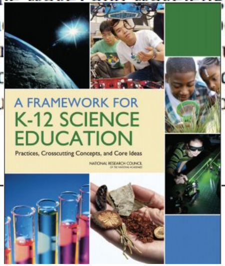
Reading a Standard

Standards Document & the 3 Dimensions

Physical Sciences: Students develop an understanding of the sources, properties, and characteristics of energy along with the relationship between energy transfer and the human body.

Physical Science Standards	Crosscutting Concepts & Background Information for Educators
3.P2U1.1	**Crosscutting Concepts:** Patterns, Cause and Effect, Scale, Proportion and Quantity; **Systems and System Models**; Energy and Matter; **Structure and Function**; Stability and Change[4]
Ask questions and investigate the relationship between light, objects, and the human eye.	
3.P2U1.2	**Background Information:** Light is seen because it affects the objects it reaches, including light, which travels from them in various directions and is de enters our eyes. Objects that are seen either **give out** or **reflec** detect. **Sound** comes from things that **vibrate** and can be dete source because the air or other material around is made to when the vibrations in the air enter our **ears**. 2 (p 21). An obj reflected from its surface enters the eyes; the color people see available light sources as well as the properties of the surface beams, they can be used, singly or in combination, to provide n too small or too far away to be seen with the naked eye.4 (p. 135) Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). Waves can add or cancel one an ending on their relative phase (i.e., relative position of peaks and t ut they emerge unaffected by each other. (Boundary: The discussic qualitative only; it can be based on the fact that two different sou on in different directions without getting mixed up.) 4 (p. 132)
Plan and carry out an investigation to explore how sound waves affect objects at varying distances.	





Dimension: Core Ideas of Knowing & Using

Dimension: Science & Engineering Practice

Dimension: Crosscutting Concepts

How does it work?
Essential and Plus Standards for High School

Essential

+

+

Earth and Space – E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe. **Earth and the Solar System** Essential standards are standards that will be assessed on the state exam and are intended for ALL students to have learned by the end of 3 credits of high school science courses.	
Essential HS.E2U1.16 Construct an explanation of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings. Earth and space Plus (+) Standards HS+E are supporting standards designed to be used with the essential standards for students taking a high school earth and space (E) course. **Plus HS+E.E2U1.13** Analyze and interpret data showing how gravitational forces are influenced by mass, and the distance between objects. **Plus HS+E.E2U1.14** Use mathematics and computational thinking to explain the movement of planets and objects in the solar system.	**Crosscutting Concepts & Background Information for Educators** **Crosscutting Concepts:** Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change[4] **Background Information:** The solar system consists of the sun and a collection of objects of varying sizes and conditions—including planets and their moons—that are held in orbit around the sun by its gravitational pull on them. This system appears to have formed from a disk of dust and gas, drawn together by **gravity**. Earth and the moon, sun, and planets have predictable patterns of movement. These patterns, which are explainable by gravitational forces and conservation laws, in turn explain many large-scale **phenomena** observed on Earth. [4 (p. 176)] Planetary motions around the sun can be predicted **using Kepler's three empirical laws**, which can be explained based on **Newton's theory of gravity.** [4 (p. 175)] Kepler's laws describe common features of the motions of orbiting objects, including their **elliptical** paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system. (Boundary: application of laws rather than memorization should be emphasized.) Gravity holds Earth in orbit around the sun, and it holds the moon in **orbit** around Earth. [4 (p. 176)]

Essential vs. Plus Standards for High School

High School **Essential** Standards

- Intended for all student to have learned by the end of three credits of high school science courses
- May be assessed on the state science assessment
- Goal to prepare students for adult science literacy

High School **Plus** Standards

- Supporting standards designed to be used with the essential standards
- For students taking a specific course in physics, chemistry, earth/space, and/or biology to prepare students for college-level courses
- May be assessed by districts but not by state

Sensemaking & Phenomena in Our Standards

Introduction

Students are naturally curious about the world and their place in it. Sustaining this curiosity and giving it a scientific foundation must be a high priority in Arizona schools. Scientific thinking enables Arizona students to strengthen skills that people use every day: solving problems creatively, thinking critically, working cooperatively in teams, using technology effectively, and valuing lifelong learning. A fundamental goal of science education is to help students determine how the world works and make sense of phenomena in the natural world. **Phenomena** are observable events that can be explained or explored. Science aims to explain the causes of these events, or phenomena, using scientific ideas, concepts, and practices (3-dimensions). **Sense-making** in science is a conceptual process in which a learner actively engages with phenomena in the natural world to construct logical and coherent explanations that incorporate their current understanding of science or a model that represents it and are consistent with the available evidence. To develop a scientific understanding of the natural world, students must be able to ask questions, gather information, reason about that information and connect it to scientific principles, theories, or models, and then effectively communicate their understanding and reasoning.

Purpose of the Arizona Science Standards

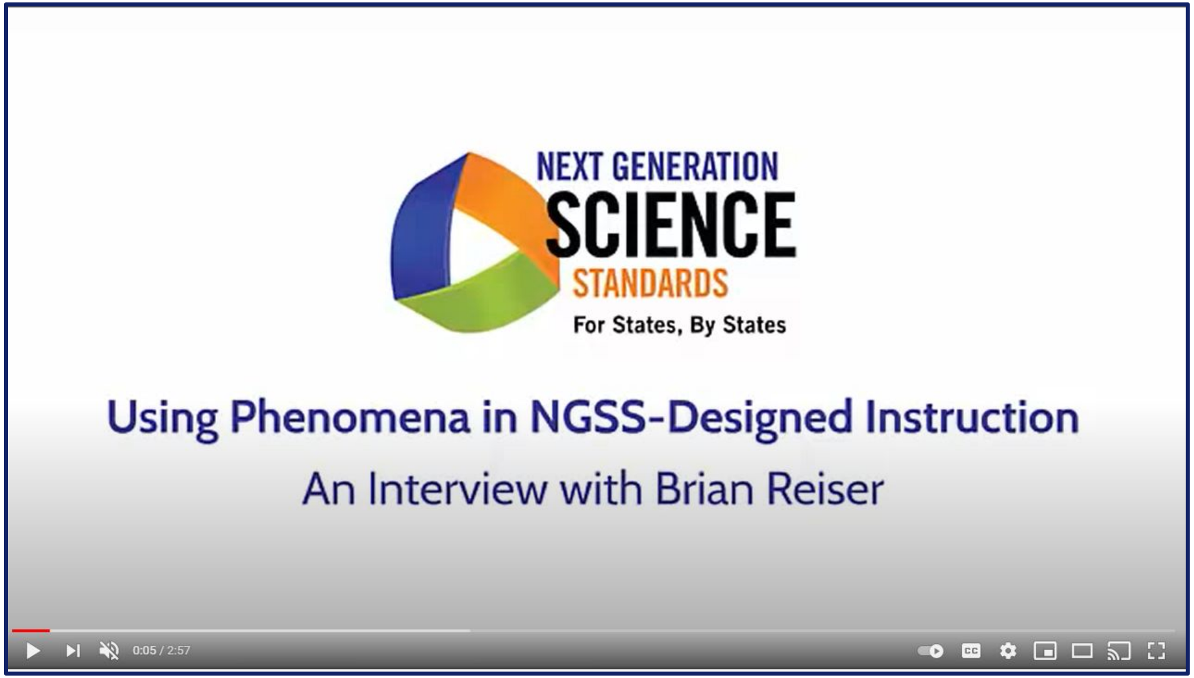
The Arizona Science Standards present a vision of what it means to be scientifically literate, and college and career ready. These standards outline what all students need to know, understand, and be able to do by the end of high school and reflect the following shifts for science education:

- Organize standards around thirteen core ideas and develop learning progressions to coherently and logically build scientific literacy from kindergarten through high school.
- Connect **core ideas**, **crosscutting concepts**, and **science and engineering practices**, to make sense of the natural world and understand how science and engineering are practiced and experienced.
- Focus on fewer, broader standards that allow for greater depth, more connections, deeper understanding, and more applications of content.

#12 in Dashboard

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

Using Phenomena



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

Webinar Pathways

#1 in Dashboard

ADE WEBINAR PATHWAYS FOR 3-DIMENSIONAL SCIENCE INSTRUCTION

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

New to 3-Dimensional Instruction? START HERE

1 Introduction to the AzSS & 3-Dimensional Instruction

- A Look at Arizona's New Science Standards
- Crosscutting Concepts: 1 of the 3 Dimensions of the AZ Science Standards
- Science and Engineering Practices: 1 of 3 Dimensions of the AZ Science Standards
- Core Ideas: 1 of 3 Dimensions of the AZ Science Standards
- Phenomena-Based 3-Dimensional Instruction

Confident in your understanding of Webinar content in Box 1?

2 Instructional Practices to Support 3-Dimensional Teaching & Learning

- Transforming Science Learning: Engaging Students in the Science & Engineering Practices Using Digital Tools
- 5-E Instructional Model & Science Notebooks
- Constructing Explnations & Arguing from Evidence using Claims, Evidence, & Reasoning (CER)
- SEP: Asking Questions: Students Drive Instruction with Driving Question Boards!

Confident in your understanding of Webinar content in Box 1 & 2?

3 Summative & Formative Assessment & Performance Tasks

- What Elementary Educators Need to Know About Performance Tasks
- What Secondary Educators Need to Know About Performance Tasks

Link to Register for Live Science & STEM Webinars | Link to All Recorded Webinars

K-2 Band: 2.P1U1.2 Plan and carry out investigations to gather evidence to support an explanation on how heating or cooling can cause a phase change in matter.

6-8 Band: 6.P1U1.1 Analyze and interpret data to show that changes in states of matter are caused by different rates of movement of atoms in solids, liquids, and gases (Kinetic Theory).

Plus HS+C.P1U1.3 Analyze and interpret data to develop and support an explanation for the relationships between kinetic molecular theory and gas laws. (Note: The plus standards are used to create a high school chemistry class, they are not honors only)

Identify the 3-Dimensions in a Standard

Crosscutting Concepts:

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

#15 in Dashboard

Thank you for sharing this space!

What questions do you have?

Use a strategy called "stack"- helps build a virtual "line" or stack

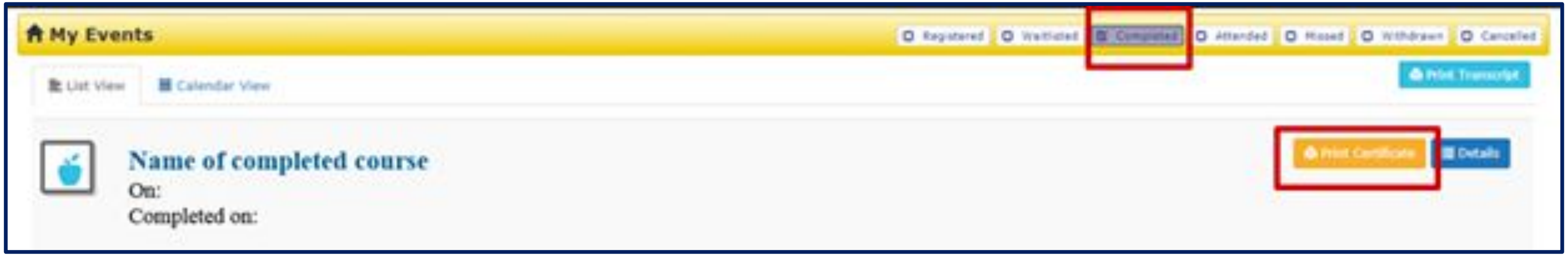
Rebecca Garelli | Rebecca.Garelli@azed.gov

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
- <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