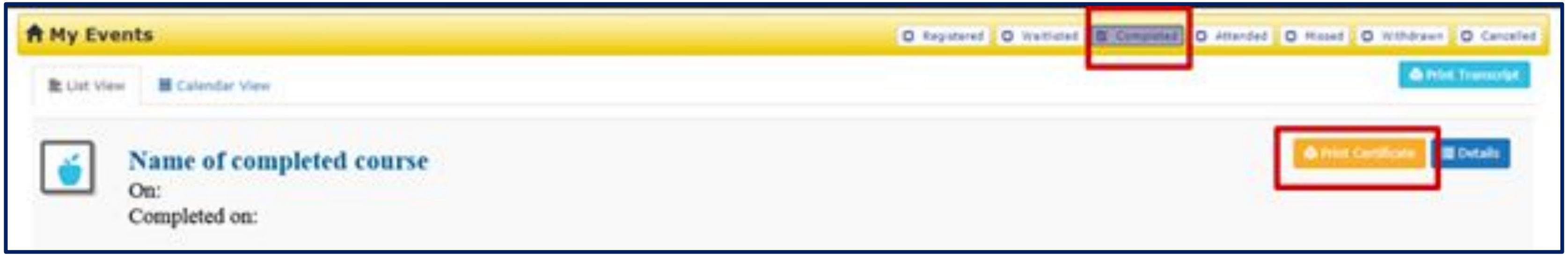
WELCOME!

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**
- **<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**

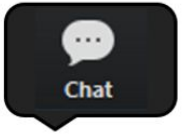
Arizona Department of Education

Guidance for Administrators: What to Look For in a 3-Dimensional Science Classroom

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

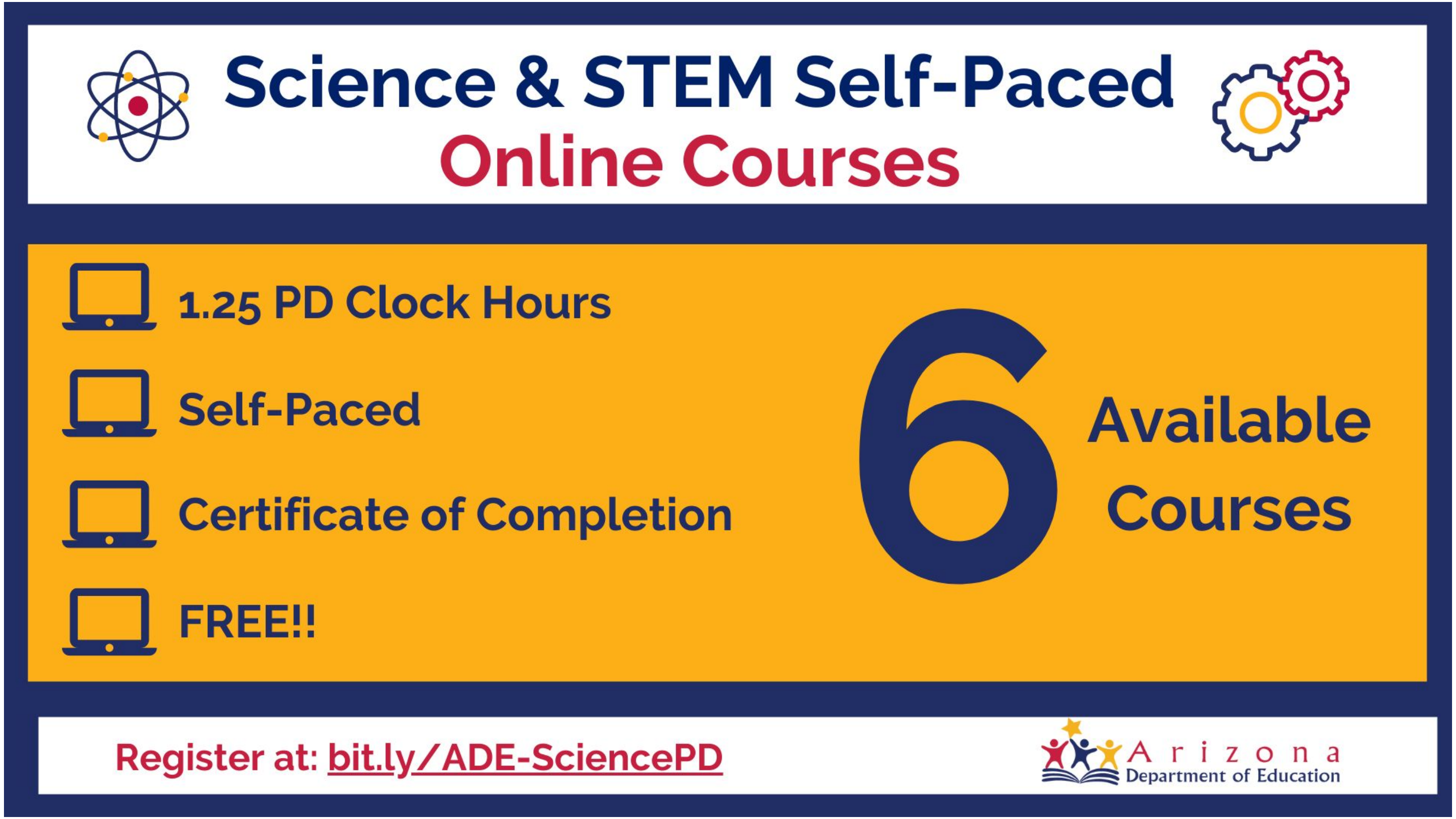
Sarah Sleasman
Science & STEM Director
Sarah.Sleasman@azed.gov

Welcome!



- Name
- Current Position
- How did you hear about this opportunity?

ADE Announcements



We are here to support!

We are here to support!

Districts ADE has/is supporting with professional learning for science:

- Cartwright
- Deer Valley
- Dysart
- Imagine Schools
- Litchfield
- Mesa
- Mohave Valley
- Phoenix Union
- Tolleson
- Washington
- Roosevelt
- Scottsdale
- Tempe Union
- Window Rock

Face to Face Events

Virtual Events

Webinar Resource Dashboard

Guidance for Administrators: What to Look For in a 3-Dimensional Science Classroom- Webinar Dashboard

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

ADE Science Standards Page | ADE Science Resource Page | ADE Science & STEM Professional Learning

1	General Resources	⊕ Presentation PDF: PDF of Slides ⊕ Recommended Book: Helping Students Make Sense of the World
2	AzSS Implementation Timeline	⊕ Implementation Timeline- Updated
3	Research from the National Academies of Science, Engineering, and Medicine (NASEM)	⊕ NASEM Reports at www.nap.edu ⊕ Synthesis of Research from How People Learn- Key Findings
4	Classroom Case Study- Ms. Sheridan and Ms. Lee	⊕ Moon Phase Vignettes (make a copy)
5	Shifts in Instruction- More of/Less of	⊕ New Vision for Science Education 1-Pager on Shifts
6	Research Used to Develop the 2018 Arizona Science Standards	⊕ PDF- K-12 Framework for Science Education ⊕ PDF- Working with Big Ideas of Science Education
7	Become Familiar with the AzSS 3-Dimensions Structure	⊕ AzSS 3-Dimensional Snapshot for Educators & Administrators
8	Teaching Channel Video on the 3-Dimensions	⊕ NGSS: A Vision for K-12 Science Education

MAKE A FORCED COPY

Chat

To: Everyone

done

1

Gray- means we will open and use

Goals for Today

- To provide administrators with tools to support educators with transitioning to the 2018 AZ Science Standards
- To deepen understanding of the new shifts in science education embedded within the AZ Science Standards

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.

ARIZONA SCIENCE TEST

Access to Science Literacy for ALL Students

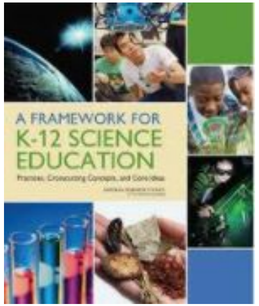
economically disadvantaged

English learners

race and ethnicity

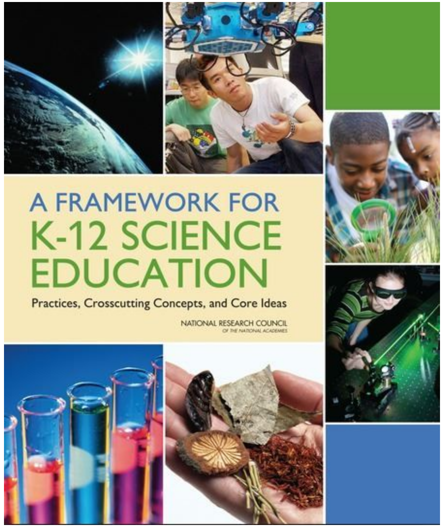
gifted and talented

students with disabilities



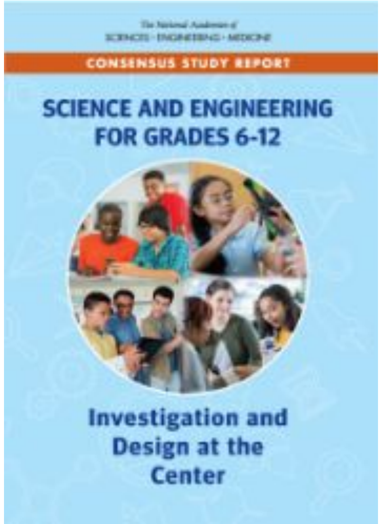
students with different cultures

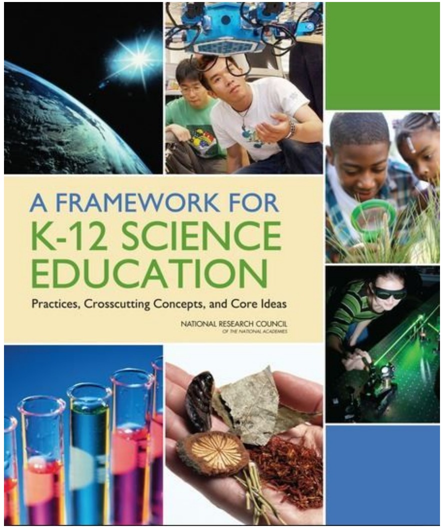
Sensemaking

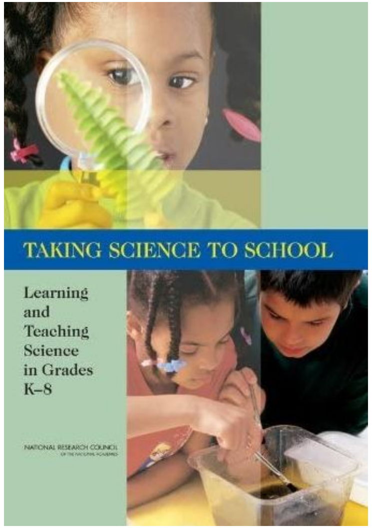


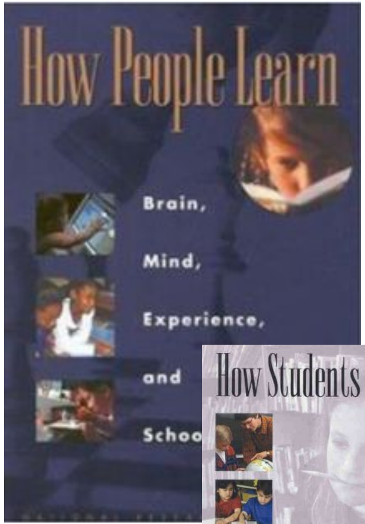
Research Used to Develop Science Standards

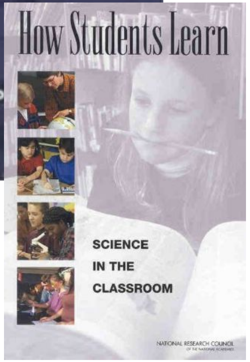
A Vision for Science Teaching and Learning Built on Research







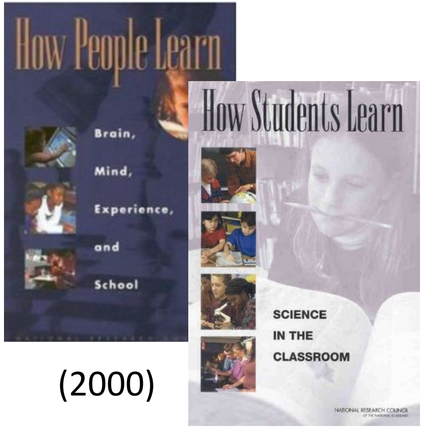




3

NASEM Reports at www.nap.edu

Key Findings About How Students Learn Science



(2000)

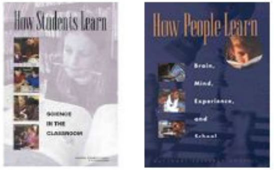
(2005)

3

Synthesis of Research from

How People Learn: Brain, Mind, Experience, and the Classroom

How Students Learn: Science in the Classroom



Adapted by BSCS from:

National Research Council. (2000). *How People Learn: Brain, Mind, Experience, and School*, Washington, DC: National Academies Press. Available for free download at www.nap.edu

National Research Council. (2005). *How Students Learn: Science in the Classroom*, Washington, DC: National Academies Press. Available for free download at www.nap.edu

KEY FINDINGS ABOUT HOW STUDENTS LEARN SCIENCE

1. Students' prior knowledge must be engaged.

2. Organizing science knowledge into conceptual frameworks is essential in developing scientific understanding.

3. Learning to monitor one's own thinking is essential in learning to think like a scientist.

Classroom Vignettes about Moon Phases

Alone Zone (12 minutes) 4

1. Highlight what the **teacher** is doing in yellow.
2. Highlight what the **student** is doing in pink.
3. **Underline** the science.

Vignettes about Moon Phases

NGSS@NSTA
STEM STARTS HERE

Case 1: Moon Phases in Ms. Sheridan's Class

The students come into Ms. Sheridan's class and find that the topic for the day is Moon phases. The day before this class, students had reviewed the order of the planets from the Sun. They had also made a chart of key characteristics of each planet.

After she introduces the topic of the day, Ms. Sheridan asks the students to raise their hands and when called on tell the class one thing they know about the Moon. Students offer ideas such as "I know we've sent rockets to the Moon" and "Isn't the Moon involved in tides?"

Case 2: Moon Phases in Ms. Lee's Class

The students in Ms. Lee's class have been working on near-Earth astronomy for a few weeks. They have been pursuing the overarching question "Why do the Sun, Moon, and stars move in our sky and change in appearance over time?" Recently, the students have been investigating the appearance of the Moon. They wonder why it is visible in the sky at different times of day and appears some nights and not others. For over a month they have been spending a few minutes each day recording the appearance of the Moon on that day in a data table in their notebooks. As the Moon goes through the cycle of phases, the students learn the technical name of each phase. Prior to this lesson, they used moonrise time data to figure out that the Moon orbits the Earth in the same direction as the Earth spins, and it takes about a month to complete one orbit.

Where do questions come from? Who is involved in figuring out how to answer the questions?
How do students get to an explanation? What is the role of agreement, disagreement, and consensus?

Debrief Vignettes

How are these two classrooms similar and/or different? What do you notice? Please share one take-away.

Chat

Case 1: Moon Phases in Ms. Sheridan's Class

The students come into Ms. Sheridan's class and find that the topic for the day is Moon phases. The day before this class, students had reviewed the order of the planets from the Sun. They had also made a chart of key characteristics of each planet.

After she introduces the topic of the day, Ms. Sheridan asks the students to raise their hands and when called on tell the class one thing they know about the Moon. Students offer ideas such as "I know we've sent rockets to the Moon" and "Isn't the Moon involved in tides?"

After three or four students have shared, Ms. Sheridan asks them if they have ever noticed that the Moon has different shapes at different times. She explains that the different shapes are called the "phases of the Moon" and puts up a list naming eight phases of the Moon. Next, she explains that today they are going to learn why the Moon's shape appears to change. She starts with the main facts about Moon phases: The phases occur in a cycle. The cycle is one revolution of the Moon around the Earth, about 28 days. She explains that the Sun is relatively far away from the Earth and the Moon. She shows the class how light from the Sun falls on the Moon, always lighting up exactly half of it. Then she explains that the part of the lit Moon you can see varies depending on where the Moon is in its orbit around the Earth. She shows the class a diagram on the smart board, walks them through the different steps in the Moon's orbit, and describes the phase that can be seen at that point in the orbit, along with telling students the name of each Moon phase that she expects them to learn.

Ms. Sheridan then tells the class that they can now try it out for themselves to see each phase of the Moon. She divides the class into eight groups and gives each group a small Styrofoam ball to represent the Moon and a larger blue ball to represent the Earth. Each group also gets a flashlight to represent the shining Sun. Ms. Sheridan gives each group one of the eight phases to prepare to demonstrate. Each group gets the name of a phase and a diagram showing the positions of the Moon, Earth, and Sun for that phase. The teacher gives each group five minutes to match the position of the Moon (the small Styrofoam ball), the Sun (flashlight), and the Earth (larger blue ball) to the diagram for its phase. She turns out the classroom lights, and students excitedly position the Moon and Sun to match their diagrams.

Then, each group shows the rest of the class its model of the positions of the Sun, Earth, and Moon for its phase. For homework, Ms. Sheridan asks students to make eight flashcards with a picture of a Moon phase on one side of the card and the name of that phase on the other. She lets them know that they will have a quiz the following day on this material and on the planets they learned about the previous day.

Case 2: Moon Phases in Ms. Lee's Class

The students in Ms. Lee's class have been working on near-Earth astronomy for a few weeks. They have been pursuing the overarching question "Why do the Sun, Moon, and stars move in our sky and change in appearance over time?" Recently, the students have been investigating the appearance of the Moon. They wonder why it is visible in the sky at different times of day and appears some nights and not others. For over a month they have been spending a few minutes each day recording the appearance of the Moon on that day in a data table in their notebooks. As the Moon goes through the cycle of phases, the students learn the technical name of each phase. Prior to this lesson, they used moonrise time data to figure out that the Moon orbits the Earth in the same direction as the Earth spins, and it takes about a month to complete one orbit.

Ms. Lee begins class on this day with a discussion to help the students summarize what they have figured out so far and what questions remain about their observations. Ms. Lee draws their attention to the main question about the Moon that started them off on their investigation: "Why does the Moon change shape during the month?" The students have collected data about the Moon's appearance with the observations made throughout the month. They know that it takes the Moon 28 days to complete a cycle as it orbits the Earth, but they still haven't figured out why the shape changes during that time.

Based on what they have discovered so far, the class refines its original question to "Why does the appearance of the Moon change as it orbits the Earth?" The students brainstorm their initial ideas about why the appar shape of the Moon might change, using what they have figured out about the orbit of the Moon aroun Earth as a starting point. In the discussion, Ms. Lee raises the question of how it is even possible to s Moon from Earth. Students draw on what they know about light sources and how light allows us to generally agree that it must be the light from the Sun reflecting off the Moon that makes part of th visible from the Earth (since the Moon is not a light source). But students are not in agreement abo would change as the Moon revolves around the Earth.

Ms. Lee suggests they try to picture what is happening as the Moon goes around the Earth and recomm they use physical props to see for themselves why the shape might appear to change. Students like the idea and are eager to see what would happen to light from the Sun as the Moon orbits the Earth. As in earlier modeling activities in their classroom, Ms. Lee has the class agree on the question the model needs to explain and then brainstorm what needs to be represented in the model. In discussion, students decide they need to represent the Earth, the Moon, and the Sun. Ms. Lee gives each group of students a Styrofoam ball and says that they can use the ball to represent the Moon. She suggests using a lamp she has without the shade to represent the Sun and places it in the center of the room so all the kids can use its light in their investigation (she also covers the windows so that the lamp "Sun" is the only light in the room). Since the goal of the activity is to see what the Moon looks like from Earth, Ms. Lee helps the students come up with the idea of using the ball and their own bodies to simulate the Moon's orbit around Earth (recalling what they had already figured out about that from the moonrise times). Before they begin, Ms. Lee asks students to state what they are trying to figure out and how they will use the props to test their ideas. The students agree that they need to figure out what parts of the Moon they can see in each part of the orbit.

The students talk actively as they engage and make notes about what they can see from each position. Once they have collected all their evidence and reported on it, the students are ready to try explaining the phenomenon. Ms. Lee asks them to discuss in their groups and draw a representation on their poster paper that shows why the Moon's appearance changes over the course of the month. Once each group has finished, she has the students put up their diagrams around the room. They do a gallery walk so they can all see what the other groups have created. Then the students spend time in their groups talking about what they have seen, trying to identify where they have agreed or disagreed with other groups and what makes for a good representation. As a whole class they then discuss the differences among the various explanations and how they have represented them. The teacher guides a discussion to help the students decide on a consensus explanation and a way to represent that explanation in a diagram. Ms. Lee tells students that their homework for the day is to write a short paragraph that they could use to explain to a friend from a different class why we see phases of the Moon from Earth. The next day in class they apply their ideas by finding pictures in children's books that should be drawn differently based on their knowledge of the Moon and its phases.

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

Science Instructional Shifts

Shift 1:

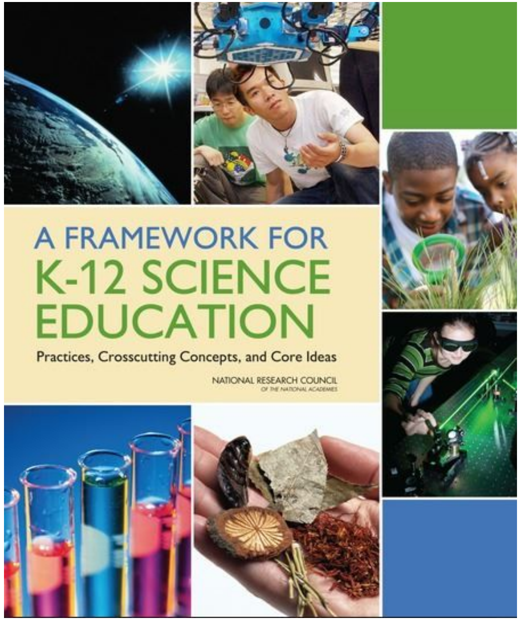
Explain phenomena and design solutions to problems

Shift 2:

***Doing* science** (three-dimensional learning)

Shift 3:

Coherent learning progressions over time



Instructional Shifts

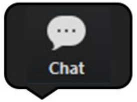
Alone Zone (3 minutes)

What are 3-5 items that resonate with you?

Waterfall Share (30 seconds)

Type in chat box, but DO NOT HIT ENTER!

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



5

A New Vision for Science Education

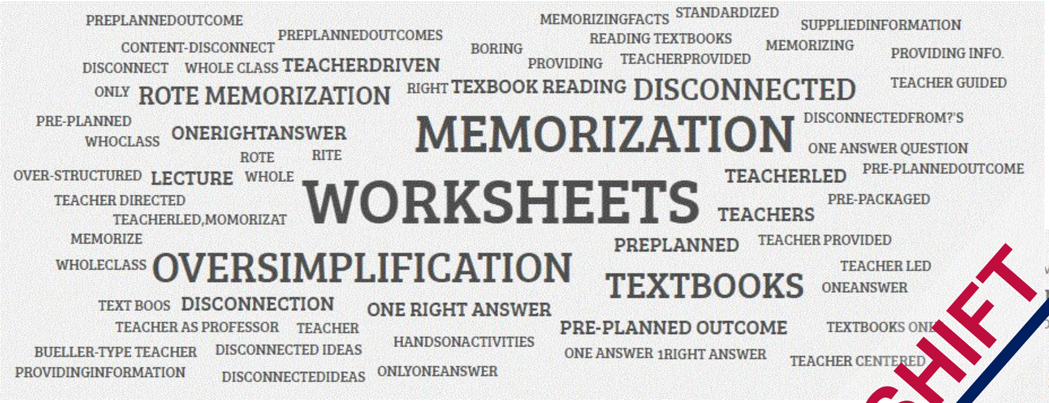
Implications of the Vision of the Framework for K-12 Science Education and the Arizona Science Standards

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

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

ARIZONA Department of Education

2004 Science Standards vs. 2018 Standards

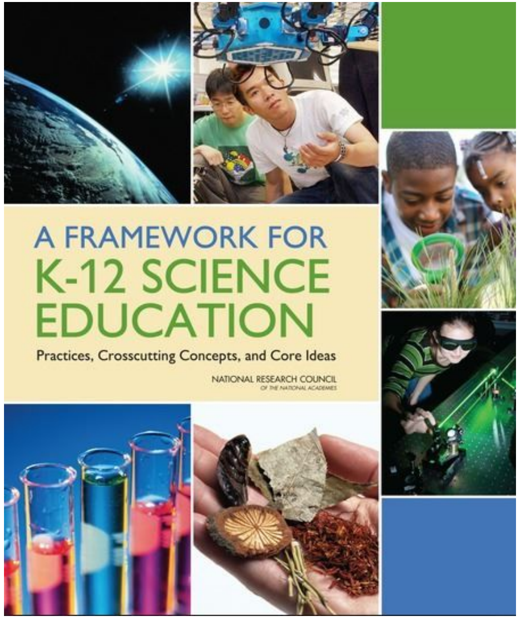
Concept 3: Energy and Magnetism Investigate different forms of energy.
PO 1. Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects.
PO 2. Construct series and parallel electric circuits.
PO 3. Explain the purpose of conductors and insulators in various 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.

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

NGSS

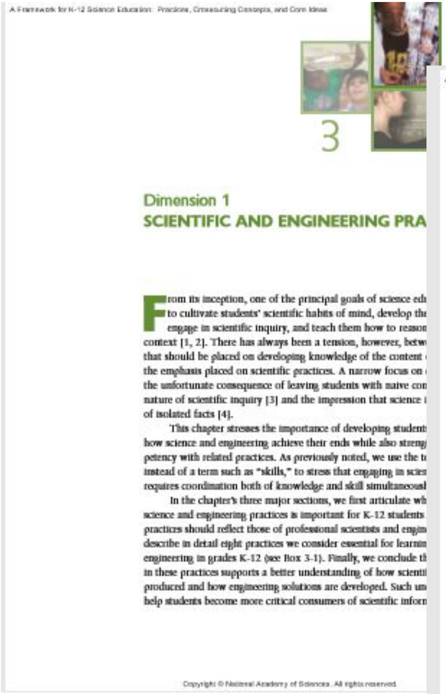
AzSS



AzSS

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

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 simultaneous

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

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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 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 Scien

In this chapter, we describe concepts that bridge disciplinary boundari
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 unde
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

83

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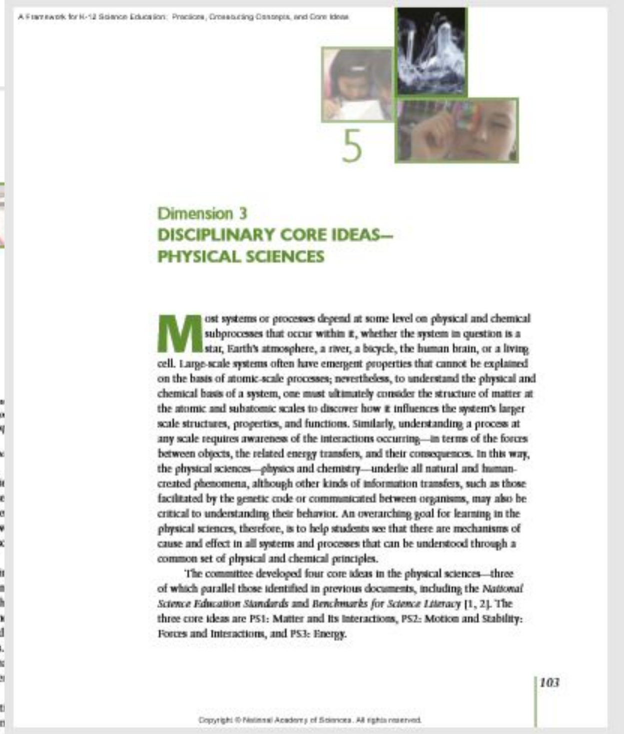

A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas

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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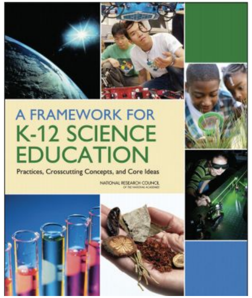

What are the 3 Dimensions of Science Instruction?

Science & Engineering Practices

Crosscutting Concepts

Core Ideas

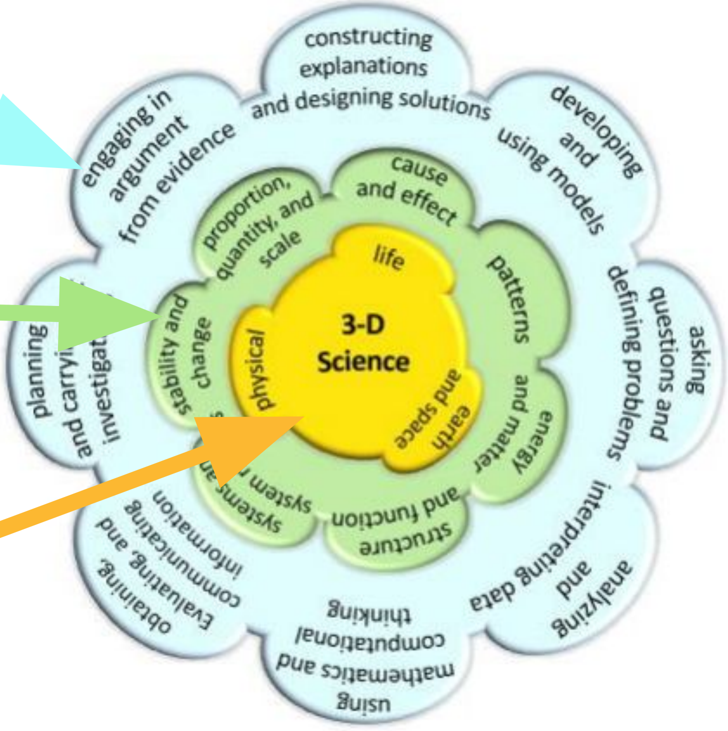

Figure 1: Three Dimensions of Science Instruction

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

Dimension 1: The Science and Engineering Practices

DO

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)*

Dimension 2: The Crosscutting Concepts

THINK

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

The core ideas of Knowing science (CIs)

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)**
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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 and its climate. (p. 24)**
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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)*

Arizona Science Standards unique Using Science (CIs)

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)**

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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

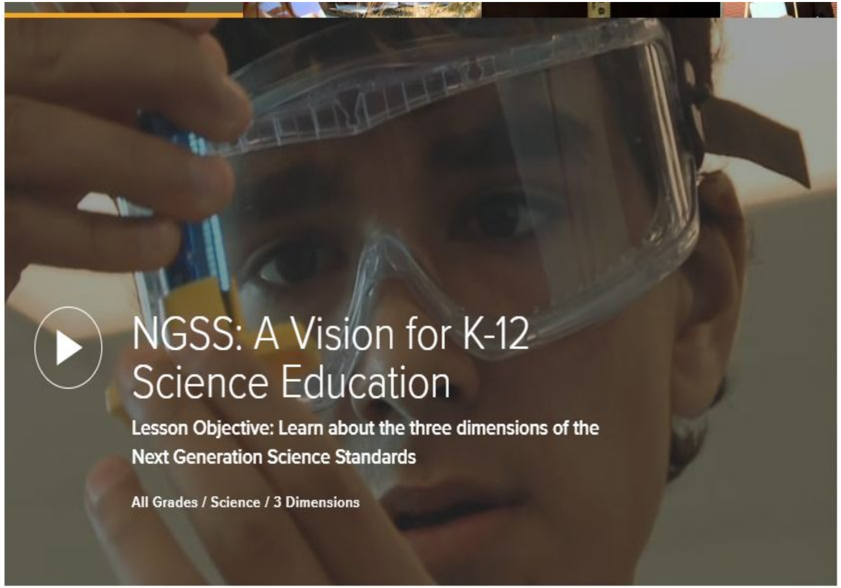
What Is 3-Dimensional Science Instruction?

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?

8



YouTube

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

Dimension 1: The Science and Engineering Practices

1

DO

1. Asking questions and defining pr s (p. 54)*
2. Developing and using mode . 5
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)*

Dimension 2: The Crosscutting Concepts

2

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)

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

3

The Core Ideas of Knowing Science

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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

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2. Developing and using models (p. 56)*
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4. Analyzing and interpreting data (p. 61)*
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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

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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

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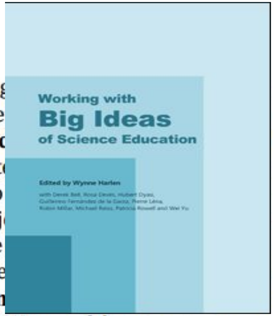
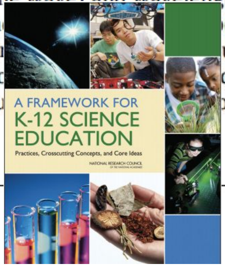
Reading a Standard

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.	**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 tr 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)
3.P2U1.2	
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

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

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)]

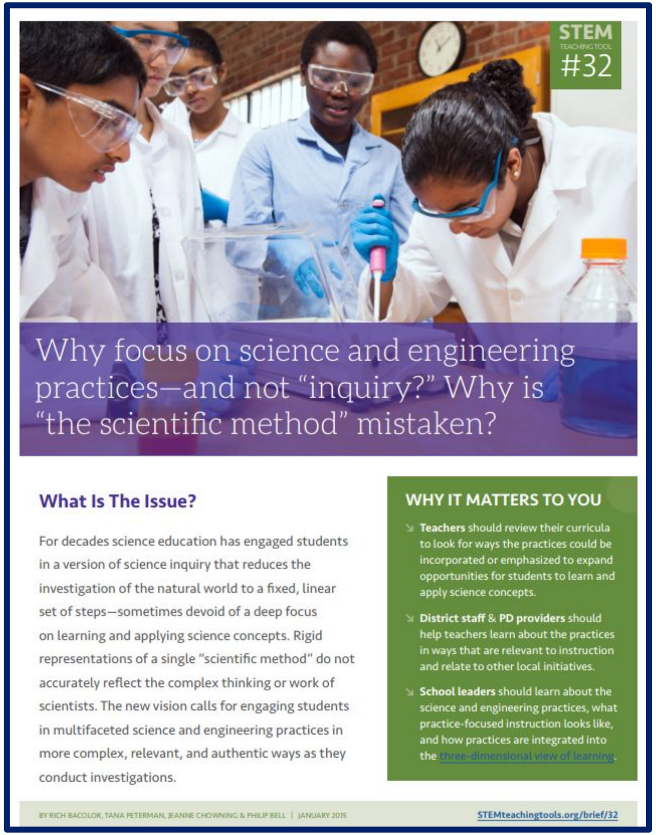
Science in Action- How Science Works

9

Shifting Instruction Away from the Scientific Method

"The notion that there is **a single scientific method of observation, hypothesis, deduction, and conclusion—a myth perpetuated to this day by many textbooks**—is fundamentally wrong. Scientists do use deductive reasoning, but they also search for patterns, classify different objects, make generalizations from repeated observations, and engage in a process of making inferences as to what might be the best explanation. Thus the picture of scientific reasoning is richer, more complex, and more diverse than the image of a linear and unitary scientific method would suggest."

— NRC Framework, p. 78



STEM TEACHING TOOL #32

Why focus on science and engineering practices—and not "inquiry?" Why is "the scientific method" mistaken?

What Is The Issue?

For decades science education has engaged students in a version of science inquiry that reduces the investigation of the natural world to a fixed, linear set of steps—sometimes devoid of a deep focus on learning and applying science concepts. Rigid representations of a single "scientific method" do not accurately reflect the complex thinking or work of scientists. The new vision calls for engaging students in multifaceted science and engineering practices in more complex, relevant, and authentic ways as they conduct investigations.

WHY IT MATTERS TO YOU

- **Teachers** should review their curricula to look for ways the practices could be incorporated or emphasized to expand opportunities for students to learn and apply science concepts.
- **District staff & PD providers** should help teachers learn about the practices in ways that are relevant to instruction and relate to other local initiatives.
- **School leaders** should learn about the science and engineering practices, what practice-focused instruction looks like, and how practices are integrated into the three-dimensional view of learning.

BY RICH BACOLOR, TANA PETERMAN, JEANNE CHOWNING & PHILIP BELL | JANUARY 2015

STEMteachingtools.org/brief/32

What Would This Look Like in the Classroom?

Photo by @CarrieDePetris

What Is The Issue?

Many schools require teachers to post the day's learning target, objective, or standard on the board. However, displaying the target concept to be learned—the disciplinary core idea that is the focus of instruction—"gives away" what students should actually be figuring out as they make sense of phenomena by engaging in the science and engineering practices. Many teachers face a dilemma when they try to meet their administrator's requirements. It is important for teachers and administrators to come to consensus around developing and using objectives that are consistent with 3D learning.

WHY IT MATTERS TO YOU

- **Teachers** should have the authority to design instruction by involving students in developing daily objectives.
- **District Staff & PD Providers** should help teachers learn how to define and sequence 3D learning performances across the units they teach that culminate in students understanding performance expectation bundles.
- **School Leaders** should learn how to see and support science instruction that engages students in making sense of phenomena and should consider how daily learning objectives might be different in a 3D instruction classroom.

BY WILLIAM R. PENUEL, MICHAEL NOVAK, TARA MCGILL, KATIE VAN HORNE & BRIAN J. REISER | MARCH 2017 STEMteachingtools.org/brief/46

What is the issue?

"Many schools require teachers to post the day's learning target, objective, or standard **on the board**. However, displaying the target concept to be learned—the disciplinary core idea that is the focus of instruction—**"gives away"** what students should actually be figuring out as they make sense of phenomena by engaging in the science and engineering practices. Many teachers face a dilemma when they try to meet their administrator's requirements. It is important for teachers and administrators to come to consensus around developing and using objectives that are consistent with 3D learning."

11

Arizona Department of Education

Vertical Progressions:

Science & Engineering Practices

12

Elements: Specific pieces of knowledge and skill that make up the practice at each grade band.

K-12 Science and Engineering Practices* Progression Matrix of Elements

For use with *Arizona Science Standards*

Science and Engineering Practices	K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices	9–12 Condensed Practices
Developing and Using Models A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations. Modeling tools are used to develop questions, predictions and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems. Measurements and observations are used to revise models and designs.	Modeling in K–2 builds on prior experiences and progresses to include identifying, using, and developing models that represent concrete events or design solutions. - Distinguish between a model and the actual object, process, and/or events the model represents. - Compare models to identify common features and differences. - Develop and/or use models (i.e., diagrams, drawings, physical replicas, dioramas, dramatizations, or storyboards) that represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed worlds. - Develop a simple model that represents a proposed object or tool.	Modeling in 3–5 builds on K–2 models and progresses to building and revising simple models and using models to represent events and design solutions. - Develop and revise models collaboratively to measure and explain frequent and regular events. - Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution. - Use simple models to describe or support explanations for phenomena and test cause and effect relationships or interactions concerning the functioning of a natural or designed system. - Identify limitations of models. - Develop a diagram or simple physical prototype to convey a proposed object, tool or process. - Use a simple model to test cause and effect relationships concerning the functioning of a proposed object, tool or process.	Modeling in 6–8 builds on K–5 and progresses to developing, using, and revising models to support explanations, describe, test, and predict more abstract phenomena and design systems. - Use and/or develop models to predict, describe, support explanations, and/or collect data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. - Develop models to describe unobservable mechanisms. - Modify models—based on their limitations—to increase detail or clarity, or to explore what will happen if a component is changed. - Use and develop models of simple systems with uncertain and less predictable factors. - Develop a model that allows for manipulation and testing of a proposed object, tool, process or system. - Evaluate limitations of a model for a proposed object or tool.	Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and explain relationships between systems and their components in the natural and designed world. - Use multiple types of models to represent and support explanations of phenomena, and move flexibly between model types based on merits and limitations. - Develop, revise, and use models to predict and support explanations of relationships between systems or between components of a system. - Use models (including mathematical and computational) to generate data to support explanations and predict phenomena, analyze systems, and solve problems. - Design a test of a model to ascertain its reliability. - Develop a complex model that allows for manipulation and testing of a proposed process or system. - Evaluate merits and limitations of two different models of the same proposed tool, process, or system in order to select or revise a model that best fits the evidence or design criteria.

Increasing sophistication

Progression Elements for Crosscutting Concepts

13

1. Patterns – Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.			
K-2 Crosscutting Statements	**3-5 Crosscutting Statements**	**6-8 Crosscutting Statements**	**9-12 Crosscutting Statements**
▪ Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.	▪ Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products. ▪ Patterns of change can be used to make predictions. ▪ Patterns can be used as evidence to support an explanation.	▪ Macroscopic patterns are related to the nature of microscopic and atomic-level structure. ▪ Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. ▪ Patterns can be used to identify cause and effect relationships. ▪ Graphs, charts, and images can be used to identify patterns in data.	▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. ▪ Classifications or explanations used at one scale may fail or need revision when information from smaller or larger scales is introduced; thus requiring improved investigations and experiments. ▪ Patterns of performance of designed systems can be analyzed and interpreted to reengineer and improve the system. ▪ Mathematical representations are needed to identify some patterns. ▪ Empirical evidence is needed to identify patterns.

2. Cause and Effect: Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.			
K-2 Crosscutting Statements	**3-5 Crosscutting Statements**	**6-8 Crosscutting Statements**	**9-12 Crosscutting Statements**
▪ Events have causes that generate observable patterns. ▪ Simple tests can be designed to gather evidence to support or refute student ideas about causes.	▪ Cause and effect relationships are routinely identified, tested, and used to explain change. ▪ Events that occur together with regularity might or might not be a cause and effect relationship.	▪ Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. ▪ Cause and effect relationships may be used to predict phenomena in natural or designed systems. ▪ Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.	▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. ▪ Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. ▪ Systems can be designed to cause a desired effect. ▪ Changes in systems may have various causes that may not have equal effects.

What to Look For in a 3-Dimensional Science Classroom

Alone Zone

(3 minutes)

14

What to Look For in a 3-Dimensional Science Classroom – Guidance for Administrators

Overview for Administrators about the Arizona Science Standards (AzSS):

- A major difference between the 2018 Arizona Science Standards and previous science standards is "3-Dimensional Learning" (3-D).
- 3-D Learning refers to the thoughtful and deliberate integration of the three dimensions: Scientific and Engineering Practices (SEPs), Core Ideas (CIs), and Crosscutting Concepts (CCCs).
- Through 3-D Learning, the AzSS emphasize that science in not a series of isolated facts.

General Information about This Document:

- This document is designed to support science classrooms in transitioning to the AzSS.
- This document is not intended to evaluate teachers, but rather to gain insights into the effectiveness of instructional practices for engaging students in 3-dimensional science learning.
- This document **should not be used as an observation "checklist,"** but can serve as a tool that describes what it might look like as science teaching and learning shifts to align with the new AzSS best practices.
- For more information about instructional shifts, please review this document. To review a quick case study comparing a "traditional" approach to instruction and a 3-dimensional approach, please read these Classroom Vignettes.

Look-For #1: Sense-Making of natural or designed phenomena that requires the use of the 3-dimensions.

Teachers:

- Present students with *observable events that occur in nature or designed systems (phenomena)* that they have to figure out how to scientifically explain.
- Guide students in their use of the eight **science and engineering practices (SEPs).**
- Guide students in their use of the seven **crosscutting concepts (CCCs).**

Students:

- Use **science and engineering practices** to observe and ask questions about phenomena, plan and carry out investigations, gather and interpret data, make claims using data as evidence, argue for and against claims using evidence, and elaborate their understanding of what causes phenomena using scientific principles provided by text or direct instruction.
- Use **crosscutting concepts** to establish underlying causality essential for making sense of science phenomena, they develop understanding of the systems being investigated, and recognize and use patterns as evidence to support explanations and arguments.

Look-For #2: Making Thinking Visible using models, explanations, and arguments that best fit the evidence available at the time.

Teachers:

- Elicit student ideas, provide neutral responses, ask students questions that encourage students to make their ideas visible.
- Provide opportunities and supports that help students make their thinking visible through representations using words and visuals.

Students:

- Share their science ideas through representations using words and visuals.
- Revise their ideas in light of new experiences, data, and/or other student ideas.

Look-For #3: Engaging ALL Students Equitably in a science community and culture that values ALL ideas and voices.

Teachers:

- Establishes classroom discussion norms, including lesson structures to facilitate participation for all students.
- Use strategies to elicit ideas from all students, such as talk protocols to provide structure and routines.
- Less use of the IRE talk pattern: teacher *Initiates* a question, student *Responds*, the teacher *Evaluates*.
- More use of a pattern of engagement that is student focused T-S-S-S-T, rather than teacher focused T-S-T-S-T.

Students:

- Adhere to norms developed to maintain a productive classroom culture.
- Listen to and respond to other's ideas.
- Paraphrase and agree/disagree with others using evidence.
- ALL students feel comfortable sharing ideas, revising ideas, and disagreeing.

Arizona Department of Education

Updated: 2.9.21

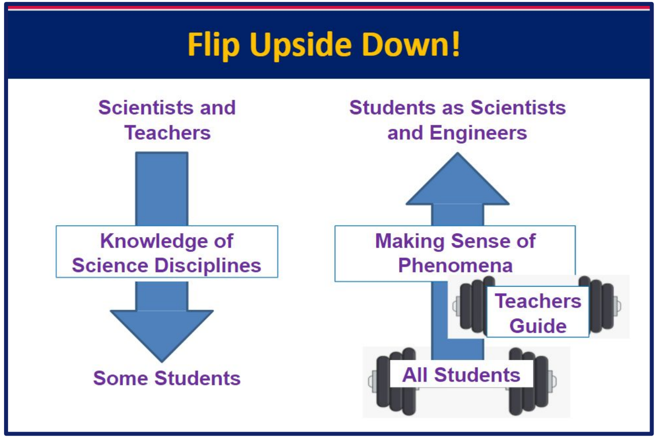
Look-For 1: Sense-making of natural phenomena that requires the use of the 3-dimensions.

Look-For #1: Sense-Making of natural or designed phenomena that requires the use of the 3-dimensions.	
Teachers: ▪ Present students with *observable events that occur in nature or designed systems (phenomena)* that they have to figure out how to scientifically explain. ▪ Guide students in their use of the eight **science and engineering practices (SEPs).** ▪ Guide students in their use of the seven **crosscutting concepts (CCCs).**	**Students:** ▪ Use **science and engineering practices** to observe and ask questions about phenomena, plan and carry out investigations, gather and interpret data, make claims using data as evidence, argue for and against claims using evidence, and elaborate their understanding of what causes phenomena using scientific principles provided by text or direct instruction. ▪ Use **crosscutting concepts** to establish underlying causality essential for making sense of science phenomena, they develop understanding of the systems being investigated, and recognize and use patterns as evidence to support explanations and arguments.

Phenomenon: *Big waves move more sand from beaches than little waves.*

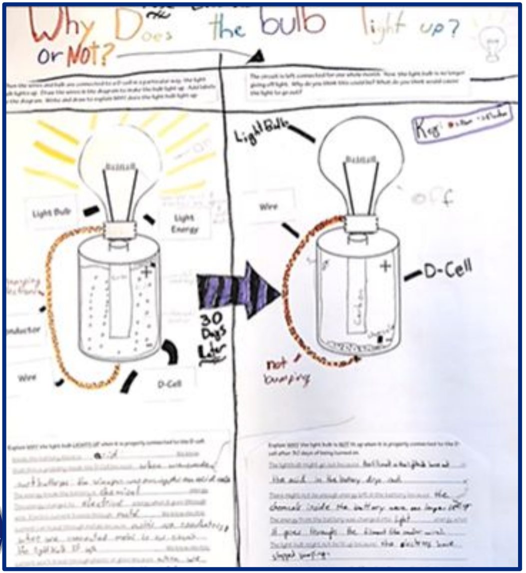
Phenomenon: *Sailboats move when the wind blows.*

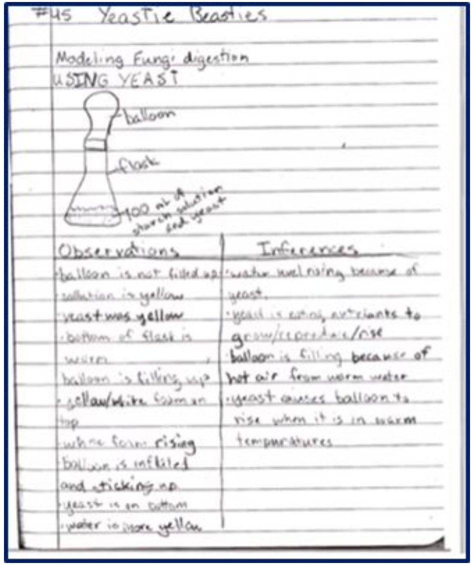
Phenomenon: *Leaves are darker on the top as compared to the underside.*

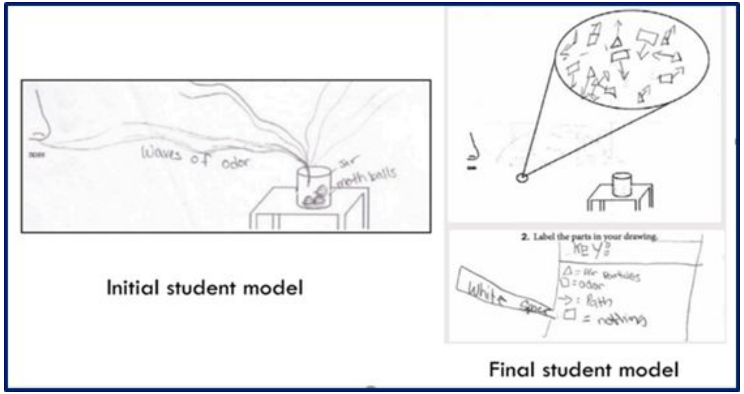


Look-For 2: Making Thinking Visible using models, explanations, and arguments that best fit the evidence available at the time.

Look-For #2: Making Thinking Visible using models, explanations, and arguments that best fit the evidence available at the time.	
Teachers: ▪ Elicit student ideas, provide neutral responses, ask students questions that encourage students to make their ideas visible. ▪ Provide opportunities and supports that help students make their thinking visible through representations using words and visuals.	**Students:** ▪ Share their science ideas through representations using words and visuals. ▪ Revise their ideas in light of new experiences, data, and/or other student ideas.







Initial student model

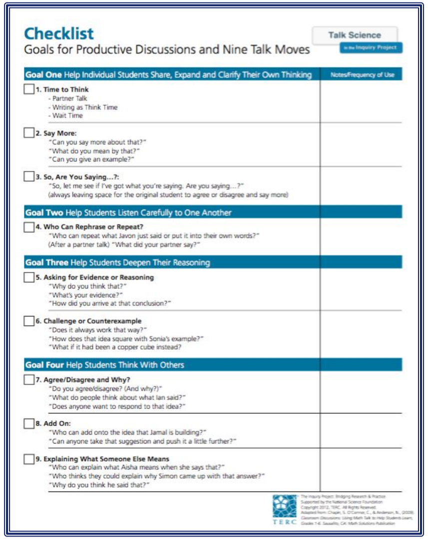
Final student model

Look-For 3: <u>Engaging ALL Students Equitably</u> in a science community and culture that values ALL ideas and voices.

Look-For #3: **Engaging ALL Students Equitably** in a science community and culture that values ALL ideas and voices.	
Teachers:	**Students:**
▪ Establishes classroom discussion norms, including lesson structures to facilitate participation for all students. ▪ Use strategies to elicit ideas from all students, such as talk protocols to provide structure and routines. ▪ Less use of the IRE talk pattern: teacher *Initiates* a question, student *Responds*, the teacher *Evaluates*. ▪ More use of a pattern of engagement that is student focused T-S-S-S-T, rather than teacher focused T-S-T-S-T.	▪ Adhere to norms developed to maintain a productive classroom culture. ▪ Listen to and respond to other's ideas. ▪ Paraphrase and agree/disagree with others using evidence. ▪ ALL students feel comfortable sharing ideas, revising ideas, and disagreeing.

Tools for Managing Student Talk

- Norms
- Dialogue protocols
- Carefully structured groups
- Accountability (a product)



Checklist

Goals for Productive Discussions and Nine Talk Moves

Talk Science

in the Inquiry Project

Goal One Help Individual Students Share, Expand and Clarify Their Own Thinking	Notes/Frequency of Use
☐ **1. Time to Think** - Partner Talk - Writing as Think Time - Wait Time	
☐ **2. Say More:** "Can you say more about that?" "What do you mean by that?" "Can you give an example?"	
☐ **3. So, Are You Saying...?:** "So, let me see if I've got what you're saying. Are you saying...?" (always leaving space for the original student to agree or disagree and say more)	
Goal Two Help Students Listen Carefully to One Another	
☐ **4. Who Can Rephrase or Repeat?** "Who can repeat what Javon just said or put it into their own words?" (After a partner talk) "What did your partner say?"	
Goal Three Help Students Deepen Their Reasoning	
☐ **5. Asking for Evidence or Reasoning** "Why do you think that?" "What's your evidence?" "How did you arrive at that conclusion?"	
☐ **6. Challenge or Counterexample** "Does it always work that way?" "How does that idea square with Sonia's example?" "What if it had been a copper cube instead?	
Goal Four Help Students Think With Others	
☐ **7. Agree/Disagree and Why?** "Do you agree/disagree? (And why?)" "What do people think about what Ian said?" "Does anyone want to respond to that idea?"	
☐ **8. Add On:** "Who can add onto the idea that Jamal is building?" "Can anyone take that suggestion and push it a little further?"	
☐ **9. Explaining What Someone Else Means** "Who can explain what Aisha means when she says that?" "Who thinks they could explain why Simon came up with that answer?" "Why do you think he said that?"	

TERC
The Inquiry Project: Bridging Research & Practice
Supported by the National Science Foundation

Adapted from: Chapin, S. O'Connor, C., & Anderson, N., (2009) Classroom Discussions: Using Math Talk to Help Students Learn, Grades 1-6. Sausalito, CA: Math Solutions Publication

Instructional Models that Support 3-Dimensional Instruction

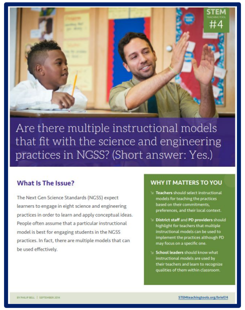
Attending To Equity

- Instructional strategies vary in terms of how they relate the science being learned to the lives and interests of the learners and the communities they are part of. Some instructional models—for example, culturally relevant instruction—actively connect to and build upon the life experiences and practices of learners.
- In order to make science teaching and learning as inclusive as possible, educators should select instructional models that engage students with the practices in different, locally relevant ways.

Inquiry Kit Instruction (modified)	Challenge Based Instruction	5E Instructional Model (BSCS)	Culturally Relevant Instruction
Project-Based Instruction	Tinkering Pedagogy	Learning Progressions	Knowledge Integration
Model-based Reasoning	Place-based Instruction	Meaningful Expertise Instruction	Emergent Investigations (RSS)

Leading Instructional Models That Fit With NGSS Science and Engineering Practices

16


STEM #4

Are there multiple instructional models that fit with the science and engineering practices in NGSS? (Short answer: Yes.)

What Is The Issue?

The Next Gen Science Standards (NGSS) expect learners to engage in eight science and engineering practices in order to learn and apply conceptual ideas. People often assume that a particular instructional model is best for engaging students in the NGSS practices. In fact, there are multiple models that can be used effectively.

WHY IT MATTERS TO YOU

- **Teachers** should select instructional models for teaching the practices based on their commitments, preferences, and their local context.
- **District staff** and **PD providers** should highlight for teachers that multiple instructional models can be used to implement the practices although PD may focus on a specific one.
- **School leaders** should know what instructional models are used by their teachers and learn to recognize qualities of them within classroom.

BY PHILIP BELL | SEPTEMBER 2014 | STEMteachingtools.org/brief/4

Recommended Time Allotment for Science Instruction

Grade	Suggested Minutes per Week	Suggested Average Minutes per Day
K	90 minutes/week	18 minutes/day
1	150 minutes/week	30 minutes/day
2	150 minutes/week	30 minutes/day
3	200 minutes/week	40 minutes/day
4	225 minutes/week	45 minutes/day
5	225 minutes/week	45 minutes/day
6	250 minutes/week	50 minutes/day
7	250 minutes/week	50 minutes/day
8	250 minutes/week	50 minutes/day
HS (3 credits)	275 minutes/week	55 minutes/day

Statewide Science Assessment-AzSci

Arizona Science Standards
2018

inform

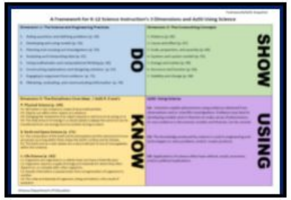
AzSCI
ARIZONA SCIENCE TEST

17 [AzSCI Assessment Website]

Administrators Toolkit & PD

Administrator Tool Kit *NEW

AzSS 3-Dimensional Snapshot for Educators & Administrators



- *NEW* Guidance for Administrators- What to Look For in a 3-Dimensional Science Classroom PD Video | PDF | Resource Page - A webinar for Administrators to help with supporting educators with the transition to the 2018 Science Standards.
- Instructional Shifts: A New Vision for Science Education- This document demonstrates what science education will involved less of, and more of when shifting to 3-dimensional standards.
- What to Look for in a 3-Dimensional Science Classroom – Guidance for Administrators- A great tool for both administrators and educators that indicates three "look-fors" in a 3-dimensional science classroom.
- STEM Teaching Tool 4- Are there multiple instructional models that fit with the science and engineering practices in NGSS? (Short answer: Yes.)
- STEM Teaching Tool 21- What school building administrators should know about the new vision for K-12 science education.
- STEM Teaching Tool 46- How to define meaningful daily learning objectives for science investigations.
- STEM Teaching Tool 32 - Why focus on science and engineering practices--and not "inquiry?" Why is "the scientific method" mistaken?

Recorded Webinars & Online Courses

Webinars

Each recorded webinar has a link to the video of the live webinar session, a PDF of the presentation slides, and the Resource Page used during the webinar. Not sure which webinar to watch first? Use this guide to help you decide which recorded webinars might work for you!

Pathway #1- New to 3-Dimensional Instruction? START HERE! Introduction to the AzSS & 3-Dimensional Instruction

- A Look at Arizona's New Science Standards Video | PDF | Resource Page | *NEW* Online Course for PD Credit
- Crosscutting Concepts: 1 of the 3 Dimensions of the AZ Science Standards Video | PDF | Resource Page | *NEW* Online Course for PD Credit
- Science and Engineering Practices: 1 of the 3 Dimensions of the AZ Science Standards Video | PDF | Resource Page | *NEW* Online Course for PD Credit
- Core Ideas: 1 of the 3 Dimensions of the AZ Science Standards Video | PDF | Resource Page | *NEW* Online Course for PD Credit
- Phenomenon-Based 3-Dimensional Instruction Video | PDF | Resource Page
- SEPs, CCCs, and Core Ideas: Putting the 3-Dimensions Together Video | PDF | Resource Page
- *NEW* Guidance for Administrators- What to Look For in a 3-Dimensional Science Classroom PD Video | PDF | Resource Page

Pathway #2- Confident in your understanding of webinar content in pathway 1? Go here next! Instructional Practices to Support 3-Dimensional Teaching & Learning

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 I Rebecca.Garelli@azed.gov | Sarah Sleasman I Sarah.Sleasman@azed.gov

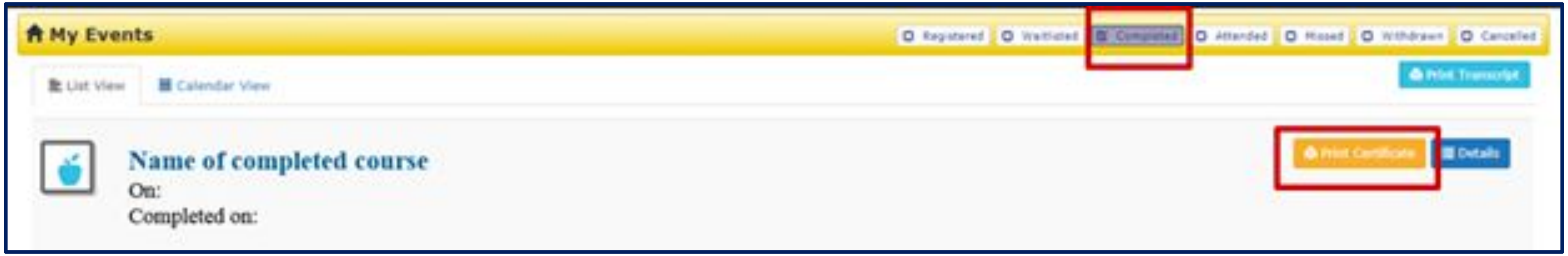
REMINDER!

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