Arizona Department of Education

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

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Webinar Resource Dashboard

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

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ADE Science Standards Page I ADE Science Resource Page I ADE Science & STEM Webinar Registration

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	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
6	Become Familiar with the AzSS 3-Dimensions Structure	⊕ AzSS 3-Dimensional Snapshot for Educators & Administrators
7	Teaching Channel Video on the 3-Dimensions	⊕ NGSS: A Vision for K-12 Science Education

MAKE A FORCED COPY

Gray- means 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

2018-19:
- 2004 Standards
- AIMS Science spring 2019

Year 1:
2019-2020 AIMS Science Assessment and begin implementation of new standards

- Implementation of new 2018 Standards
- AIMS Science spring 2020
- Field Test for item types
- Request waiver from USDOE for forms field test for 2021

Year 2:
2020-2021 Implementation year for standards and transition year for assessment

- Continue implementing 2018 Standards
- ~~AIMS Science spring 2021~~
- Forms Field Testing

Year 3:
2021-2022 Implementation year for standards and assessment

New Science Assessment:

5th grade: 3/4/5

8th grade: 6/7/8

11th Grade 9/10/11 Essential Standards

ARIZONA SCIENCE TEST

#3 in Dashboard

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.

#2 in Dashboard

Access to Science Literacy for ALL Students

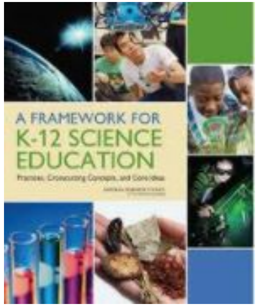
economically disadvantaged

English learners

race and ethnicity

gifted and talented

students with disabilities



students with different cultures

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

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…

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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

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

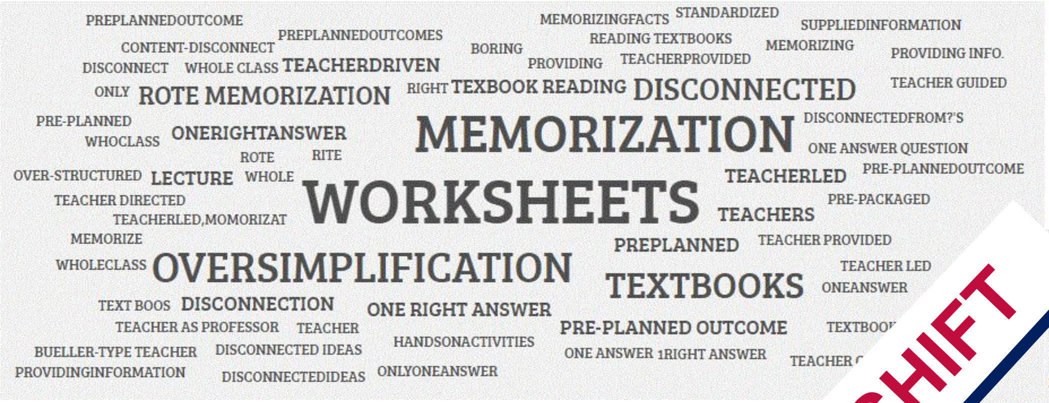
SCIENCE EDUCATION WILL INVOLVE LESS:	SCIENCE EDUCATION WILL INVOLVE MORE:
Rote memorization of facts and terminology	Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning.
Learning of ideas disconnected from questions 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

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

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2004 Science Standards vs. 2018 Standards

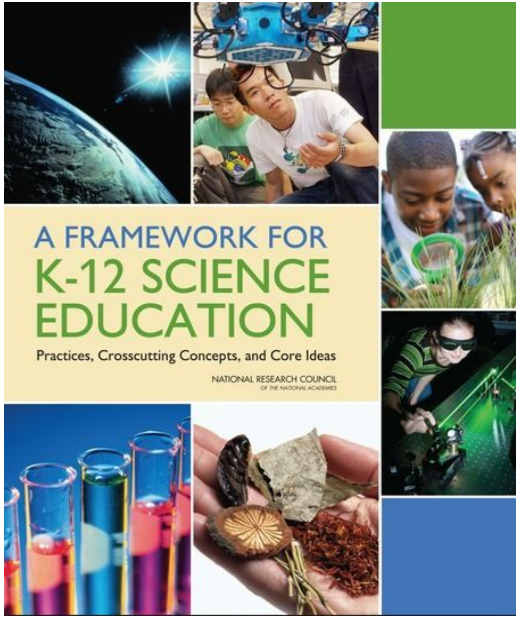
Concept 3: Energy and Magnetism Investigate different forms of energy.
PO 1. Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects.
PO 2. Construct series and parallel electric circuits.
PO 3. Explain the purpose of conductors and insulators in various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

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

4

Dimension 2
CROSSCUTTING CONCEPTS

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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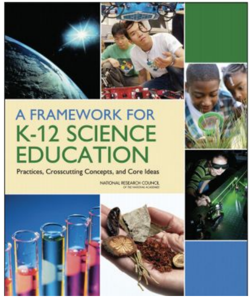


What are the 3 dimensions?

Science & Engineering Practices

Crosscutting Concepts

Core Ideas

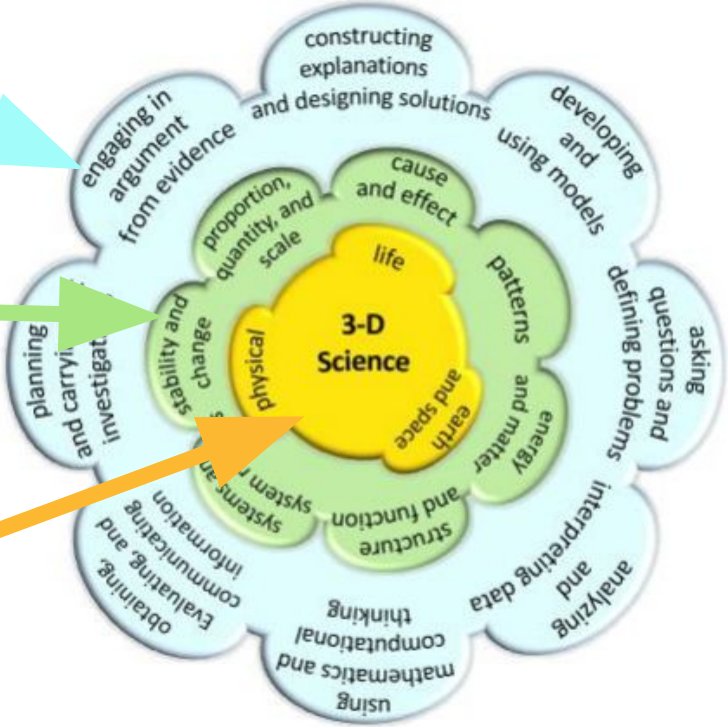


Figure 1: Three Dimensions of Science Instruction

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)**
P3: Changing the movement of an object requires a net force to be acting on it. (p. 22)**
P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event. (p. 23)**

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

E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate. (p. 24)**
E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe. (p. 25)**

L: Life Science (p. 142)*

L1: Organisms are organized on a cellular basis and have a finite life span. (p. 26)**
L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms. (p. 27)**
L3: Genetic information is passed down from one generation of organisms to another. (p. 28)**
L4: The unity and diversity of organisms, living and extinct, is the result of evolution. (p. 29)*

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)**

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)**

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

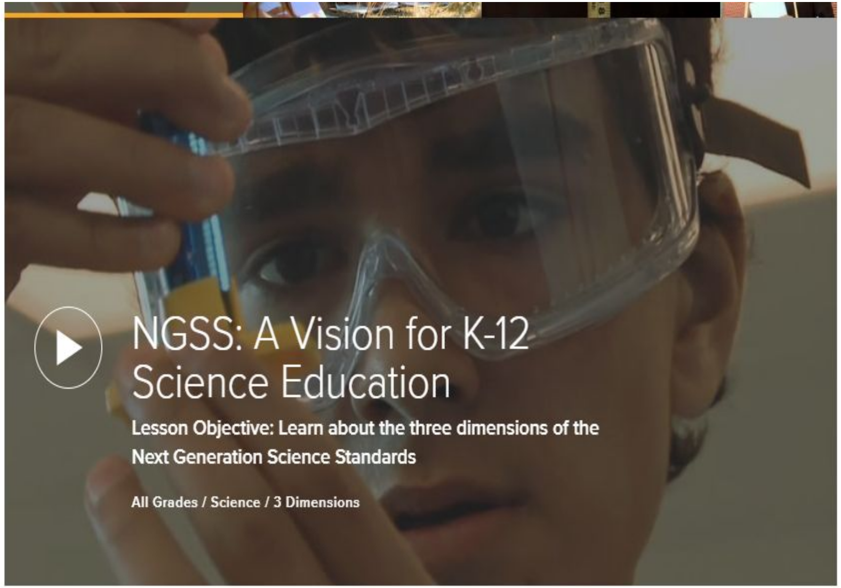
#6 in Dashboard

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?



#7 in Dashboard

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SEPs

1

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CCCs

2

Dimension 2: The Crosscutting Concepts

THINK

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2. Cause and effect (p. 87)*
3. Scale, proportion, and quantity *
4. Systems and system model)*
5. Energy and matter (p. 9
6. Structure and function (p. 96)*
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Dimension 3: The Core Ideas of Knowing Science and The Core Ideas of Using Science

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

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#6 in Dashboard

Science in Action- How Science Works

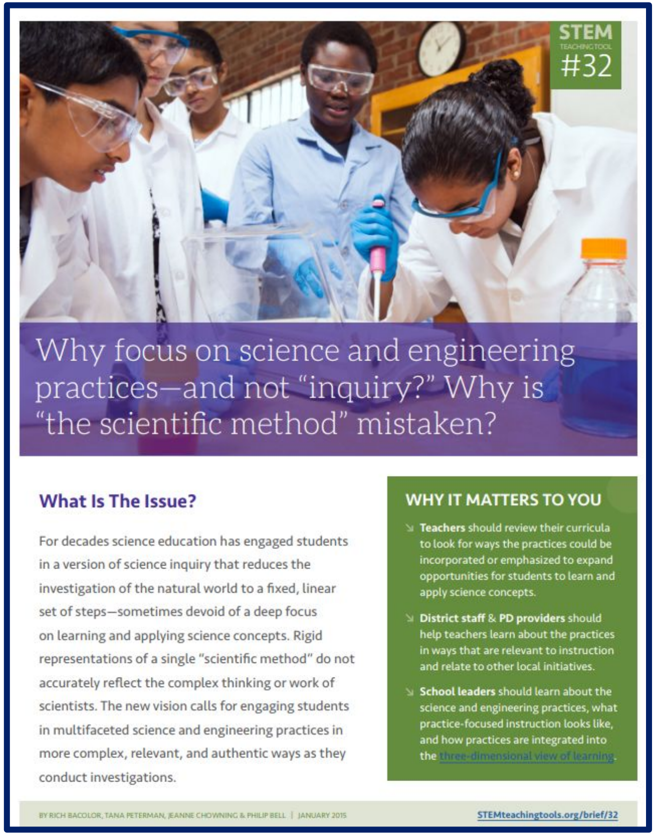
#8 in Dashboard

Shifting Instruction Away from the Scientific Method

"The notion that there is a single scientific method of observation, hypothesis, deduction, and conclusion—a <u>myth</u> 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

#9 in Dashboard



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.

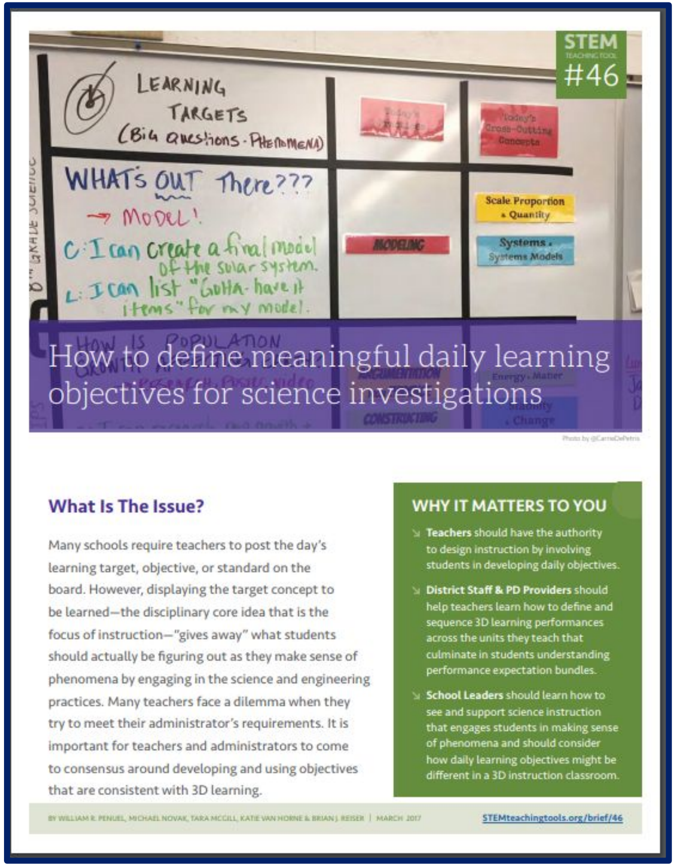
WHY IT MATTERS TO YOU

- **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?


STEM TEACHING TOOL #46

How to define meaningful daily learning objectives for science investigations

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 <u>**on the board**</u>. 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**.**"

#10 in Dashboard

Vertical Progressions:

Science & Engineering Practices

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

#11 in Dashboard

Progression Elements for Crosscutting Concepts

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.

#12 in Dashboard

What to Look For in a 3-Dimensional Science Classroom

#13 in Dashboard

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.

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

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

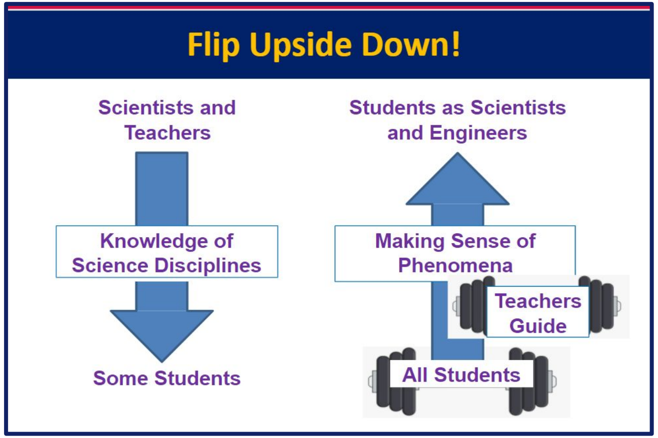
Look-For #1: Sense-Making of natural or designed phenomena that requires the use of the 3-dimensions.

Teachers:	Students:
▪ 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).**	▪ 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.*

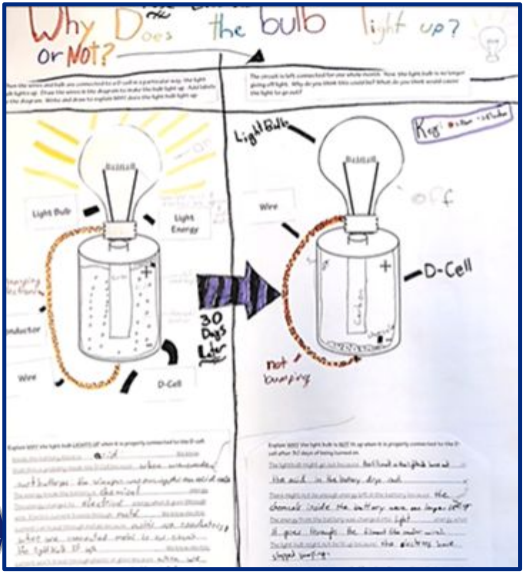
Phenomenon: *Sailboats move when the wind blows.*

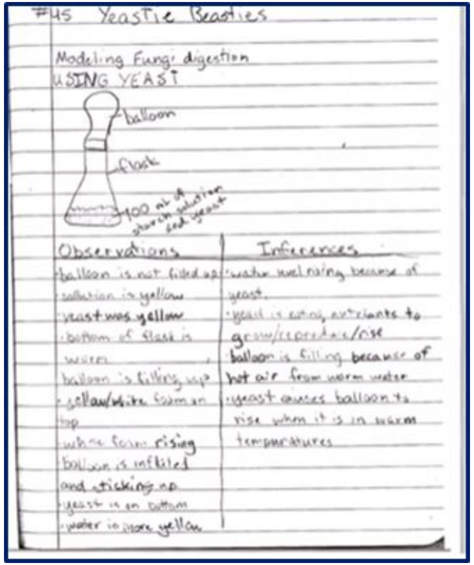
Phenomenon: *Leaves are darker on the top as compared to the underside.*

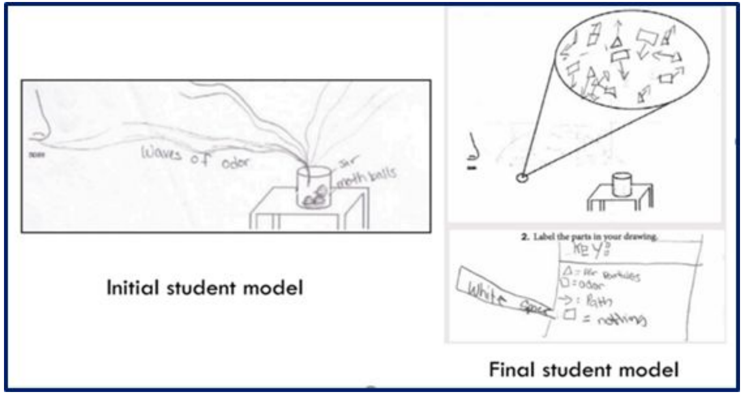


Look-For 2: Making Thinking Visible using models, explanations, and arguments that best fit the evidence available at the time.

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: Engaging ALL Students Equitably 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?"	

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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

#14 in Dashboard

ARIZONA Department of Education

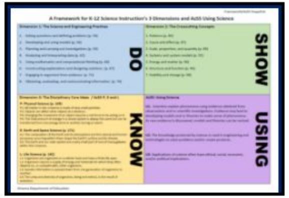
Administrators Toolkit & PD

NEW STANDARDS SUPPORT MATERIALS

▸ Planning Tools *NEW

▾ Administrator Tool Kit *NEW

AzSS 3-Dimensional Snapshot for Educators & Administrators



- 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 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?

PROFESSIONAL LEARNING OPPORTUNITIES

▸ Professional Development

▾ Recorded Webinars

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/Dashboard used during the webinar.

- *NEW* ADE Webinar Pathways for 3-Dimensional Science Instruction- Not sure which webinar to watch first? Use this guide to help you decide which recorded webinars might work for you!
- *Updated 2/21* A Look at Arizona's New Science Standards Video | PDF | Resource Page
- 5-E Instructional Model and Science Notebooks Video | PDF | Resource Page
- *Updated 3/31* Phenomenon-Based 3-Dimensional Instruction Video | PDF | Resource Page
- Science and Engineering Practices: 1 of the 3 Dimensions of the AZ Science Standards Video | PDF | Resource Page
- Crosscutting Concepts: 1 of the 3 Dimensions of the AZ Science Standards Video | PDF | Resource Page
- Constructing Explanations and Arguing from Evidence using Claims, Evidence, Reasoning (CER) Video | PDF | Resource Page
- Core Ideas: 1 of the 3 Dimensions of the AZ Science Standards Video | PDF | Resource Page
- What Secondary Science Educators Need to Know About Performance Tasks Video | PDF | Resource Page
- What Elementary Science Educators Need to Know About Performance Tasks Video | PDF | Resource Page
- SEP Asking Questions: Students Drive Instruction with Driving Question Boards! Video | PDF | Resource Page
- Transforming Science Learning: Engaging Students in the Science & Engineering Practices Using Digital Tools Video | PDF | Resource Page
- SEPs, CCCs, and Core Ideas: Putting the 3-Dimensions Together Video | PDF | Resource Page

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

Thank you for sharing this space!

What questions do you have?

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