

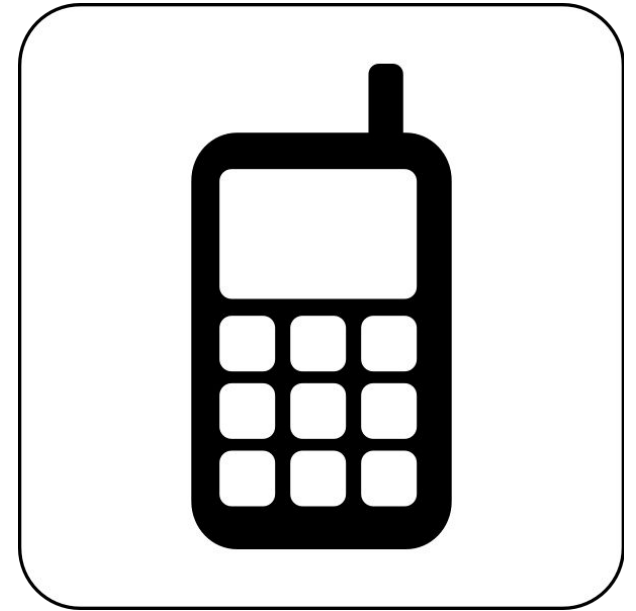
Secondary Science Curriculum Adoption 2023-2024 Committee Meeting

Thursday, October 19, 2023
SUSD Oak Campus

Call to Order



Housekeeping



Roll Call and Introductions

The Committee

Group A

*Earth and Space Science,
Oceanography/Astronomy,*

Christopher Donovan
Paula Sabato
Marissa Blanco-Johnson
Providence Ryan
Rissel Langbacker

Group B

*Environmental Science,
AP Environmental Science
Zoology/Botany*

Julie Koshy
Jen MacColl
Micah Sandys
Jaclyn Papa
Jodi Meyers
Kim Salaway

Group C

Astrophysics

Steve Millam
Dr. Nagib Balfakih
Michael Bengert
Dr. Michelle Watt

Committee Support

Dr. Kim Dodds Keran - Director of Teaching and Learning

- Committee Co-Chair

Johanna Kaiser - Science Academic Coach

- Committee Co-Chair

Dede Johnston - Instructional Materials Coordinator

Roll Call - Introductions

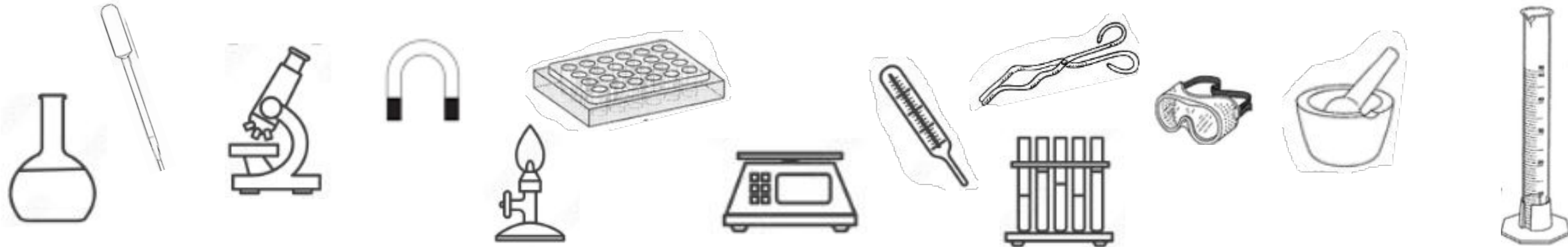
Name

Role (teacher, parent, administrator, etc.)

School/Learning Community

I am most like a _____ because _____. *OR*

My favorite piece of science equipment is _____, because _____.



Sign In Sheets

Please record arrival time on the sign-in sheet as you arrive. Record departure time if you are leaving before the meeting officially adjourns.

Agenda

Agenda for Thursday, October 19, 2023

1. Call to Order
2. Welcome
3. Roll Call and Introductions
- Information/Discussion and Possible Action**
4. Approval of Agenda - **Action Item**
5. Open Meeting Laws, Public Records, and Conflict of Interest
6. Committee Goals
7. Committee Norms and Expectations
8. Committee Timeline
9. Arizona Science Standards Overview
10. Vendor Criteria Letter
11. Arizona Department of Education Resources
12. Future Meetings



Scottsdale *Unified* School District
Engaging all students in world-class, future-focused learning

NOTICE and AGENDA
SECONDARY SCIENCE CURRICULUM ADOPTION
COMMITTEE 2023-2024
SCOTTSDALE UNIFIED SCHOOL DISTRICT NO. 48

Date: Thursday, October 19, 2023 **Time:** 3:30 - 5:30 pm

Pursuant to A.R.S. §38-431.02, notice is hereby given to the members of the Secondary Science Curriculum Adoption Committee and to the general public that on Thursday, October 19, 2023, at 3:30 PM, at the SUSD Oak Campus, 7501 E Oak St, Scottsdale, AZ 85257, the Secondary Science Curriculum Adoption Committee 2023-2024 will hold a meeting. One or more members of the Committee and non-member participants will participate in the meeting in-person.

The Agenda for the meeting is:

1. Call to Order
2. Welcome
3. Roll Call and Introductions
- Information/Discussion and Possible Action**
4. Approval of Agenda - **Action Item**
5. Open Meeting Laws, Public Records, and Conflict of Interest
6. Committee Goals
7. Committee Norms and Expectations
8. Committee Timeline
9. Arizona Science Standards Overview
10. Vendor Criteria Letter
11. Arizona Department of Education Resources
12. Future Meetings

SECONDARY SCIENCE CURRICULUM ADOPTION COMMITTEE 2023-2024 MATERIALS WILL BE AVAILABLE TWENTY-FOUR (24) HOURS IN ADVANCE OF THE MEETING, AT THE SCOTTSDALE UNIFIED SCHOOL DISTRICT, MOHAVE DISTRICT ANNEX, 8500 E. JACKRABBIT ROAD, SCOTTSDALE, AZ 85250-6768.

Date Posted: October 17, 2023

Action Item

Discussion and Approval of Meeting Agenda for October 19, 2023

Open Meeting Laws, Public Records, and Conflict of Interest

Open Meeting Law & Public Records Law*

*This

presentation was created by Jennifer MacLennan of Gust Rosenfeld
and is being used with her permission.

Nicholas B. Buzan, Esq.

General Counsel

Scottsdale Unified School District

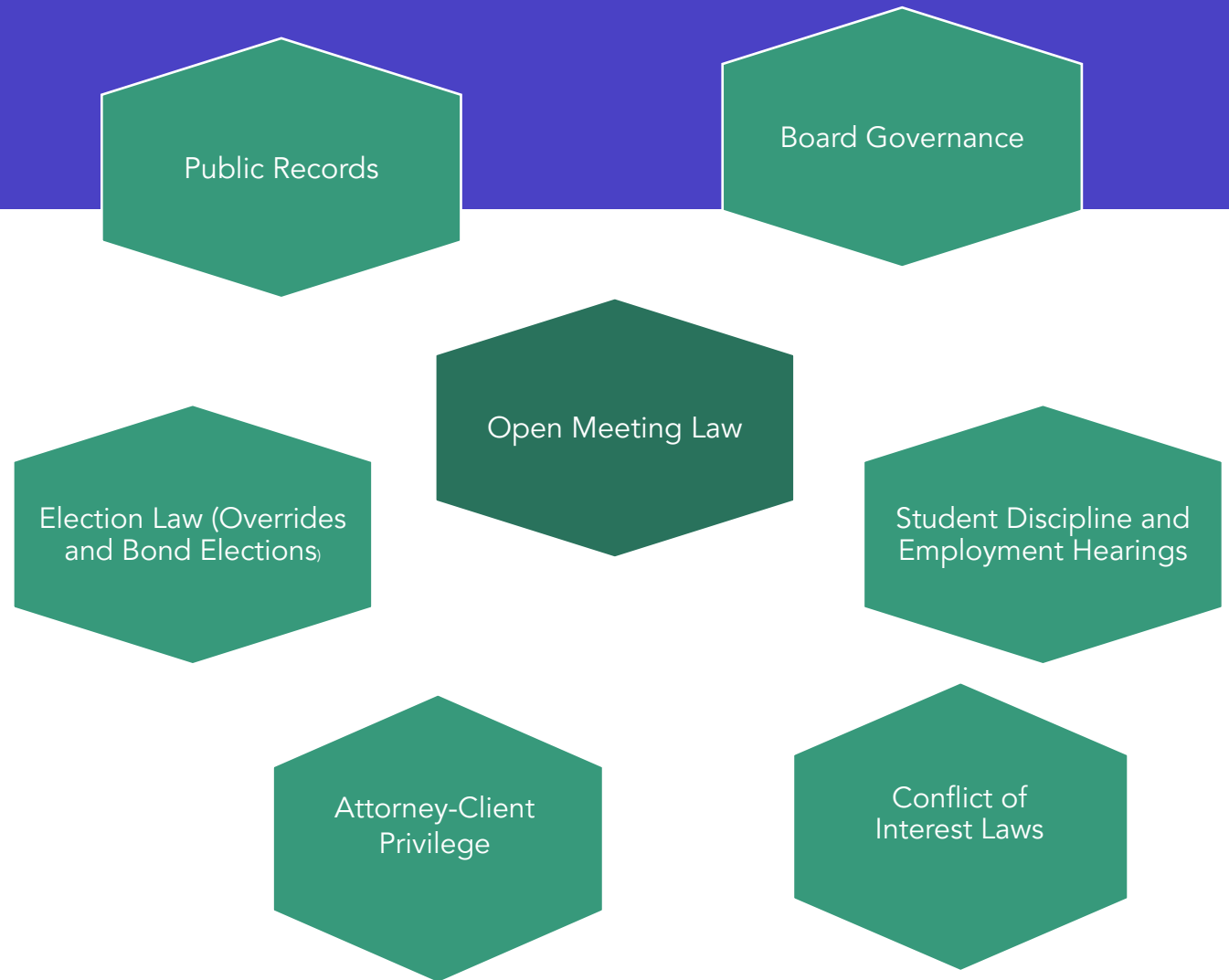


Agenda



- Public Records Law
- Open Meeting Law- what is it? why comply?
 - Notice
 - Agenda
 - Executive Sessions
- Questions?

Introduction



Public Records



Public Records Law

- The general policy of this State with respect to public inspection of governmental records is set forth in A.R.S. § 39-121: "Public records and other matters in the custody of any officer shall be open to inspection by any person at all times during office hours."

Public Records Law

- Personal Documents
- Although most documents in a public officer's possession are public records, documents that relate solely to personal matters and have no relation to official duties are not public records even if a public officer or agency possesses them or uses public funds to create them.
- Emails one specific example

Confidentiality Concerns/Best Interests

- Although there is a presumption in favor of access to public records, this presumption may be outweighed by legitimate government considerations of privacy and the best interests of the State.
- Scottsdale USD v. KPNX- teacher's dates of birth example

Confidential by Statute

- Over 300 laws in Arizona protecting confidentiality
- Teacher evaluations
- Medical data
- Student records
- Executive session minutes
- DCS records

Cumbersome Requests

- If the custodian of public records does not promptly respond to record requests and promptly furnish records that are subject to disclosure, access will be deemed denied. A.R.S. § 39-121.01(E).
- “‘Prompt,’ . . . mean[s] ‘quick to act or to do what is required,’ or ‘done, spoken, etc. at once or without delay.’” W. Valley View, Inc. v. Maricopa County Sheriff’s Office, 216 Ariz. 225, 230, ¶ 21, 165 P.3d 203, 208 (App. 2007)

Who is subject to OML (Besides a quorum of the Board)?

- All standing , special, or advisory committees or subcommittees of, or appointed by the Board.
- “Advisory Committee”
 - Officially established by motion or order of the public body or by the presiding officer.
 - Appointed to make a recommendation concerning a decision to be made or considered by the public body.

Does not include a committee established by the Superintendent.

Who is subject to OML (Besides a quorum of the Board)?

What if we direct the superintendent to establish an advisory committee?

What if we direct who is on the committee?

What if Board members serve on the committee?

A quorum

- Majority
- Vacancies count in determining what your quorum is.

Agendas

- How specific does it have to be? Be as specific as possible, but if it is for executive session, don't defeat the purpose..
- Lists of employees and vouchers.
 - Available at a public place at least twenty-four hours ahead of the meeting.

Agendas

Superintendent and Board Reports.

- Notwithstanding subsection H of this section, the chief administrator, presiding officer or a member of a public body may present a brief summary of current events without listing in the agenda the specific matters to be summarized, if:
 1. The summary is listed on the agenda.
 2. The public body does not propose, discuss, deliberate or take legal action at that meeting on any matter in the summary unless the specific matter is properly noticed for legal action.

OML in the Age of Technology

Emails.

One member to all Board members generally a bad idea but okay if:

- From superintendent
- No ongoing discussion;
- one member replies to you personally without sharing;
- But NOT okay if Board member proposes legal action.

OML in the Age of Technology

Text Messages.

- Public record or no? Probably.
- Sending and receiving them during the meeting
- public thinks you are up to something.

OML in the Age of Technology

Twitter, Facebook, and Statements to the press.

Public statement on a position you are going to take is not a violation.

BUT commenting between a quorum would be a violation.

Call to the Public

- Reasonable time, place and manner.
- Crowd control.
 - Recess, recess, recess.
 - Give opportunity to register support or opposition without talking.
- Responding:

At the conclusion of an open call to the public, individual members of the public body may respond to criticism made by those who have addressed the public body, may ask staff to review a matter or may ask that a matter be put on a future agenda. This does not mean a discussion.

Executive Sessions 38-431.03(A)

(A)(1) Personnel.

(A)(2) Confidential records.

(A)(3) Legal advice.

(A)(4) Instruct your attorney(s).

(A)(5) Instruct your representatives regarding negotiations with employee organizations regarding salaries, salary schedules or compensation.

(A)(6) international and interstate negotiations.

(A)(7) Instruct your representatives regarding negotiations for the purchase, sale or lease of real property.

Executive Sessions 38-431.03(A)

Who may attend—only those persons “whose presence is reasonable necessary in order for the public body to carry out its executive responsibilities.”

Executive Sessions 38-431.03(A)(1)

Personnel

1. Does the employee have a right to attend? No. Just a right to have matter discussed in public.
2. Does the employee have a right to minutes? Yes.
3. Can this paragraph be used to discuss reorganization? Not unless specific employees are discussed.
4. 24 hour notice to employee—does this also apply to non-employee applicants? Yes.

Executive Sessions 38-431.03(A)(2)

Confidential Records

1. Student Records.
2. Teacher Evaluations.
3. Medical records

Executive Sessions 38-431.03(A)(3)

Legal Advice

Cannot be used as a ruse to talk to each other.

“Once the members of the public body commence any discussion regarding the merits of enacting the legislation or what action to take based upon the attorneys' advice, the discussion moves beyond the realm of legal advice and must be open to the public.”

City of Prescott v. Town of Chino Valley

Executive Sessions 38-431.03(A)(4)

Instructing your Attorney

- When is a vote not a vote?
- Applies to:
 - contracts that are the subject of negotiations,
 - pending or contemplated litigation or
 - settlement discussions conducted in order to avoid or resolve litigation.
- But you should also take the (silly?) step of voting in public.
Johnson v. Tempe Elementary.
- Minutes should reflect instructions.

Legal Advice . . .

- Of course, e-session discussions are confidential.
- But . . . What happens if attorney advice gets out?
- Only the Board may waive attorney-client privilege.



Nicholas B. Buzan

nbuzan@susd.org

Thank you



Scottsdale *Unified* School District
Engaging all students in world-class, future-focused learning.

Teaching and Learning
Secondary Science Curriculum Adoption Committee
8900 East Jackrabbit Road
Scottsdale, AZ 85250

Telephone: 480-484-9009
Web site: www.susd.org

Dear Committee Member:

You have been selected to participate in the evaluation of the above referenced Invitation for Bid/Request for Proposal. Your selection was based upon your technical qualifications in this area and your ability to develop an objective/subjective analysis of each bid/proposal.

It is essential that the integrity of this process be maintained to ensure that each bidder/offeree is given fair and equal consideration. Your familiarity with particular brands, types of products, material, or firms may tend to influence your evaluation; however, you are required in this specific instance to be particularly objective and guard against any tendency that might skew your evaluation in favor of a personal preference.

You are required to report to the Committee Chair, Dr. Kimberly Dohda Kerns, any actual or potential conflict of interest as defined in A.R.S. 38-503.

An additional consideration is the legal mandate to maintain strict security and confidentiality regarding the content of any bid/proposal, as well as the proceedings of the Evaluation Committee meetings during the evaluation process. Now that this process has started, it is essential that any contact with the offeror by through, and by, the Chairman of the Evaluation Committee.

In addition, the Evaluation Committee Member shall not communicate, except during formal Committee meetings, with any offeror or potential sub contractor to that offeror prior to award nor shall that Member discuss bid/proposals or their evaluation with anyone other than the Chairperson and Evaluation Committee Members. This statement is mandatory.

To emphasize the importance of the above considerations, you are asked to sign the following statement:

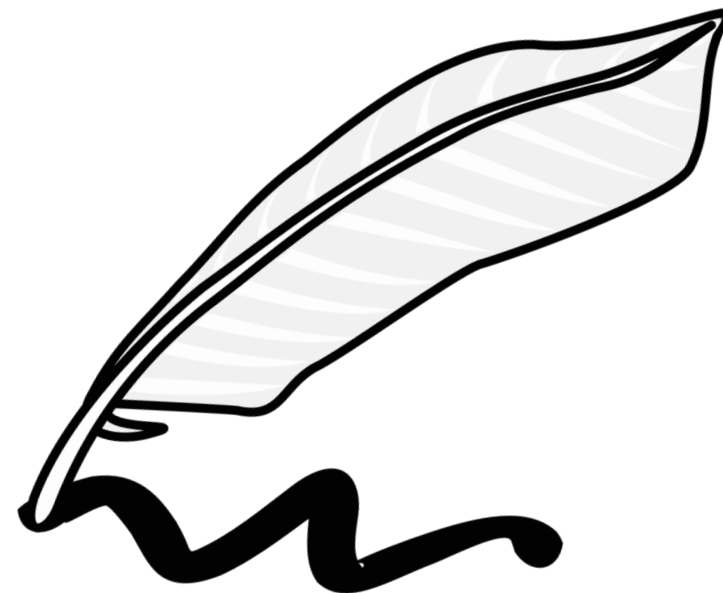
I have read and understood the above and agree to be bound by the rules and procedures represented. I know of no conflict of interest on my part nor have I committed any inducements or accepted any gratuity or favors that would compromise my impartiality. I will maintain all deliberations of the Evaluation Committee in strict confidence during this process. My recommendations shall be based upon objective/subjective review of the bid(s)/proposal(s) and the appropriate award criteria from the bid/proposal in accordance with the School District Procurement code.

Printed Name

Signature

Position

Use of Form Recommended by Attorney General's Office
Source: State Procurement Office
D-56 (10/2000)



Committee Goals

SUSD Strategic Plan

GOAL 1: **ACADEMIC EXCELLENCE**

Challenge and inspire students to reach high levels of achievement so they thrive as confident, dynamic, future-ready learners equipped to pursue their passions and ambitions. Commitments:

1.1: Provide learning opportunities that ensure all students graduate prepared for relevant and viable postsecondary higher learning and careers.

1.2: Cultivate critical and creative thinking by integrating problem-based learning opportunities throughout the curriculum.

GOAL 5: **OPTIMIZED RESOURCES**

Generate and utilize resources to maximize educational opportunities in order to ensure organizational health.

5.3 *Ensure equitable distribution of resources to meet the needs of our students.*

Committee Purpose and Objective

Purpose

The purpose of the Secondary Science Curriculum Adoption Committee is to review, evaluate, and recommend quality and appropriate textbooks and instructional resources for approval by the district Governing Board.

Objective

The committee will:

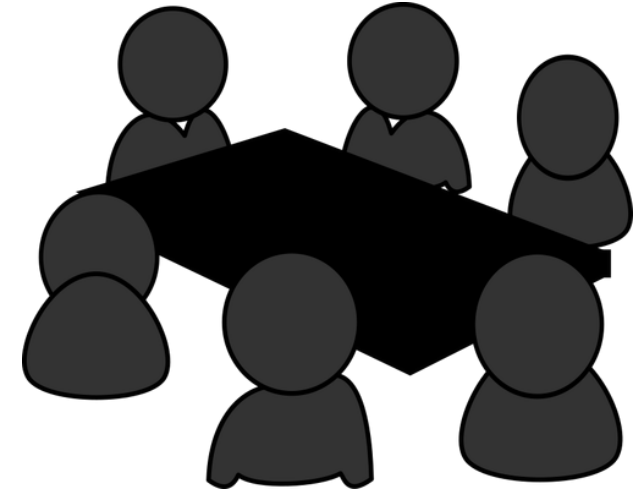
- Learn about current best practices in three-dimensional science instruction including (but not limited to):
 - explaining phenomena and/or designing solutions to problems,
 - using science and engineering practices to actively engage students in science learning,
 - integrating disciplinary core ideas and crosscutting concepts to drive student learning,
 - science sensemaking,
 - three-dimensional performance assessments.
- Learn about Arizona Science Standards and Arizona science education requirements.
- Review rubric criteria to be used to evaluate science textbooks and resources.
- Review and evaluate science textbooks and instructional resources.
- Recommend textbooks and instructional resources to the Governing Board for formal approval and adoption.

Courses Included in this Adoption Cycle

- Earth and Space Science (on level and honors)
- Oceanography/Astronomy
- Environmental Science
- AP Environmental Science
- Zoology/Botany (on level and honors)
- Honors Astrophysics

Committee Norms and Expectations

Committee Norms



Establishing norms:

- **Encourages behaviors that allow groups to work together successfully.**
- **Allows groups to dialogue, engage productively in conflict, discuss and decide, invent and problem solve.**
- **Make it safe to examine one's practice and talk about difficult to discuss topics.**

Key Question:

How must we conduct ourselves to allow us to work together most successfully to accomplish our goals?

Norms

Be fully present.

Listen to understand and ask questions for clarification.

Take care of your needs.

Be open to new ideas.

Invite and welcome the contributions of every member.

Support the group's recommendation after consensus is reached.

Be mindful of how often and how long you speak.

Questions and challenges are welcomed. Question and challenge the idea, not the person.

Clarifying Decision-Making Process

Defining Consensus

Defours et al - Definition of Consensus:

All points of view have been heard.

The will of the group is evident even to those who most oppose it.

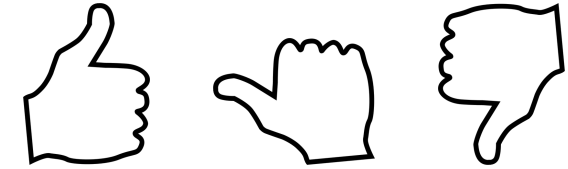
If all members of a committee/group must agree - or if every member of a committee can veto taking action - groups will be subjected to constant inaction... a state of perpetual status quo.

Without a shared understanding of consensus, persons determine their own standards.

Consensus decision making is a group decision making process that seeks consent of all participants where everyone's opinions are heard and understood. It is an acceptable resolution; one that can be supported, even if it is not the "first choice" or "favorite" of each individual.

Clarifying Decision-Making Process

Defining Consensus



Consensus is...

- Consenting to a proposal because **group members choose to cooperate** with the direction of the **group rather than insist on their personal preference.**
- ***“Is this proposal something you can live with?”*** While group members may be willing to go along with a proposal, **they do not actually need to favor it above another choice.**
- To ***“consent”***. This means that even if group members disagree, **there is still overall consent to move forward** in order to settle the issue.

Words Create Worlds

Away from Deficit-Framing Language → Towards Asset-Based Language

Deficit-Framing Language	Asset-Based Language
needs driven	strengths driven
problems focused	opportunity focused
externally focused	internally focused
What is missing that we must go find?	What is present that we can build on?
Examples of using asset-based language	
Kids and teachers can't remember all the different websites and passwords to log into online curriculum resources.	Teachers and students are most successful when online curriculum can be accessed through Single Sign-On and the SUSD Clever portal.
My students can't read this level of text.	Students in my class have varied reading levels. Some would benefit from access to resources such as text to speech and interactive texts to help them read and understand passages.
There is not enough prep time for teachers to make presentations and assessments from scratch.	Teachers will have more time to prepare lessons and activities if provided with presentations and resources created by the curriculum to use as a foundation.

Words Create Worlds

STEM Teaching Tool: Constructive Conversation Resource Cards



Constructive Conversation Resource Cards

Create

Evaluate and Compare

Clarify

Prompts

- Can you elaborate on...? OR Can you clarify the part about...?
- What do you mean by...?
- Say more about...
- How is _____ important?
- I understand the part about _____, but I want to know _____.
- Can you be more specific?
- Is what I said clear? OR Does that make sense?
- What do you think?

Responses

- I think it means _____.
- More specifically, it is _____, because _____.
- An analogy might be...
- It is important because...
- To paraphrase what you just said...
- It sounds like you think that...
- It all boils down to...
- A different way to say it is...

Prompts

- What is our idea?
- How can we combine these ideas?
- What do we need to do?
- What are other points of view?
- What do you think about?
- Why...? How...? I wonder...

Responses

- One idea could be...
- My hypothesis is...
- That reminds me of...
- I noticed the pattern of...
- I think it depends on...

Fortify/Support

Prompts

- Can you give an example from the materials?
- Where does it say that?
- What is an example from other readings/materials?
- What is an example from your life?
- What is the strongest support for _____? How does it support the idea?

Responses

- For example...
- In the materials/text, it says...
- Remember in the other subject we studied...
- One example from my life is...
- One case that illustrates this is...
- Some strong supporting evidence is...

Prompts

- How can we decide which is the more _____ issue?
- How does the evidence for your argument compare to mine?
- What criteria do we use to evaluate the weight of evidence?
- How do we compare "apples" of _____ to the "oranges" of _____?
- Which has the strongest evidence?
- What is your opinion? Why?
- How might we take the best from both sides?
- How is that evidence stronger than this evidence?

Responses

- I think we should use the criteria of _____ because _____.
- _____ is strong evidence because...
- A point of disagreement that I have is...
- Even though it seems valid that _____, I disagree because...
- That is a valid point, but...
- I think the negatives of _____ outweigh the positives of _____.

Committee Timeline

Proposed Timeline

Date	Description
Thursday, October 19, 2023	Committee Meeting, 3:30 - 5:30 pm, Oak Campus
Tuesday, October 24, 2023	Letters sent to vendors requesting materials to be submitted for review
Monday, October 30, 2023	Committee Meeting, 3:30 - 5:30 pm, Oak Campus
Monday, November 6, 2023	Vendor deadline to submit Letter of Participation and/or complete Letter of Participation Google Form
Monday, November 27, 2023	Vendor materials due date
Monday, December 4, 2023	Committee Meeting, 3:30 - 5:30 pm, Oak Campus - Materials Review
Monday, December 11, 2023	Public Review of Materials Window Opens
Monday, December 11, 2023	Committee Meeting, 3:30 - 5:30 pm, Oak Campus - Materials Review
Monday, December 18, 2023	Committee Meeting, 3:30 - 5:30 pm, Oak Campus - Materials Review

Proposed Timeline - Continued

Date	Description
Monday, January 8, 2024	Committee Meeting, 3:30 - 5:30 pm, Oak Campus - Materials Review - IF NEEDED
Friday, January 12, 2024	Finalist vendors notified and invited to participate in Vendor Presentation Days
Monday, February 5, 2024	Secondary Science Teacher Curriculum Open House, 3:00 - 5:00, Oak Campus
Tuesday, February 6, 2024	Group A Vendor Presentation Day, Time TBD (8:00 - 3:00), Oak Campus
Wednesday, February 7, 2024	Group C Vendor Presentation Day, Time TBD (8:00 - 12:00), Oak Campus
Thursday, February 8, 2024	Group B Vendor Presentation Day, Time TBD (8:00 - 3:00), Oak Campus
Monday, February 12, 2024	Final Committee Meeting, 3:30 - 5:30 pm, Oak Campus
Monday, February 26, 2024	Optional Governing Board Presentation Practice, 3:30 - 5:00, Oak Campus
Tuesday, March 5, 2024	SUSD Governing Board Meeting, 6:00 pm, Coronado High School Presentation/Information Session, 1st Read
Tuesday, April 9, 2024	SUSD Governing Board Meeting, 6:00 pm, Coronado High School 2nd Read, Possible Action Item

Arizona Science Standards

Standards vs. Curriculum vs. Instruction

Standards - What students need to know, understand, and be able to do by the end of each grade (end of high school). The WHAT

Curriculum - Resources adopted by districts to be used in the classroom to teaching the standards. The HOW (part 1)

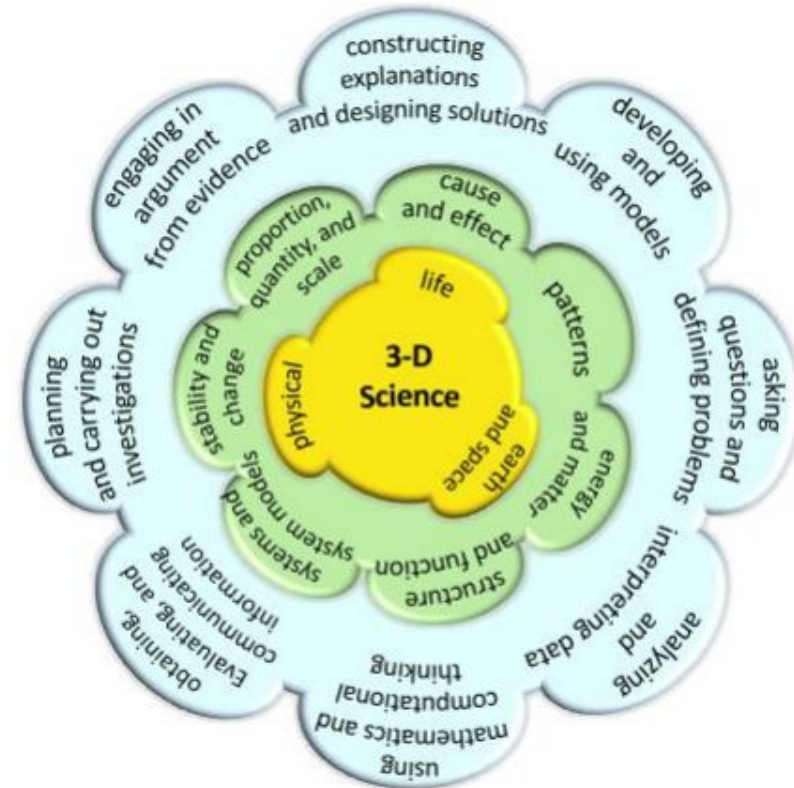
Instruction - The methods used by teachers to teach their specific students. The HOW (part 2)

3 Dimensions of Teaching and Learning Science

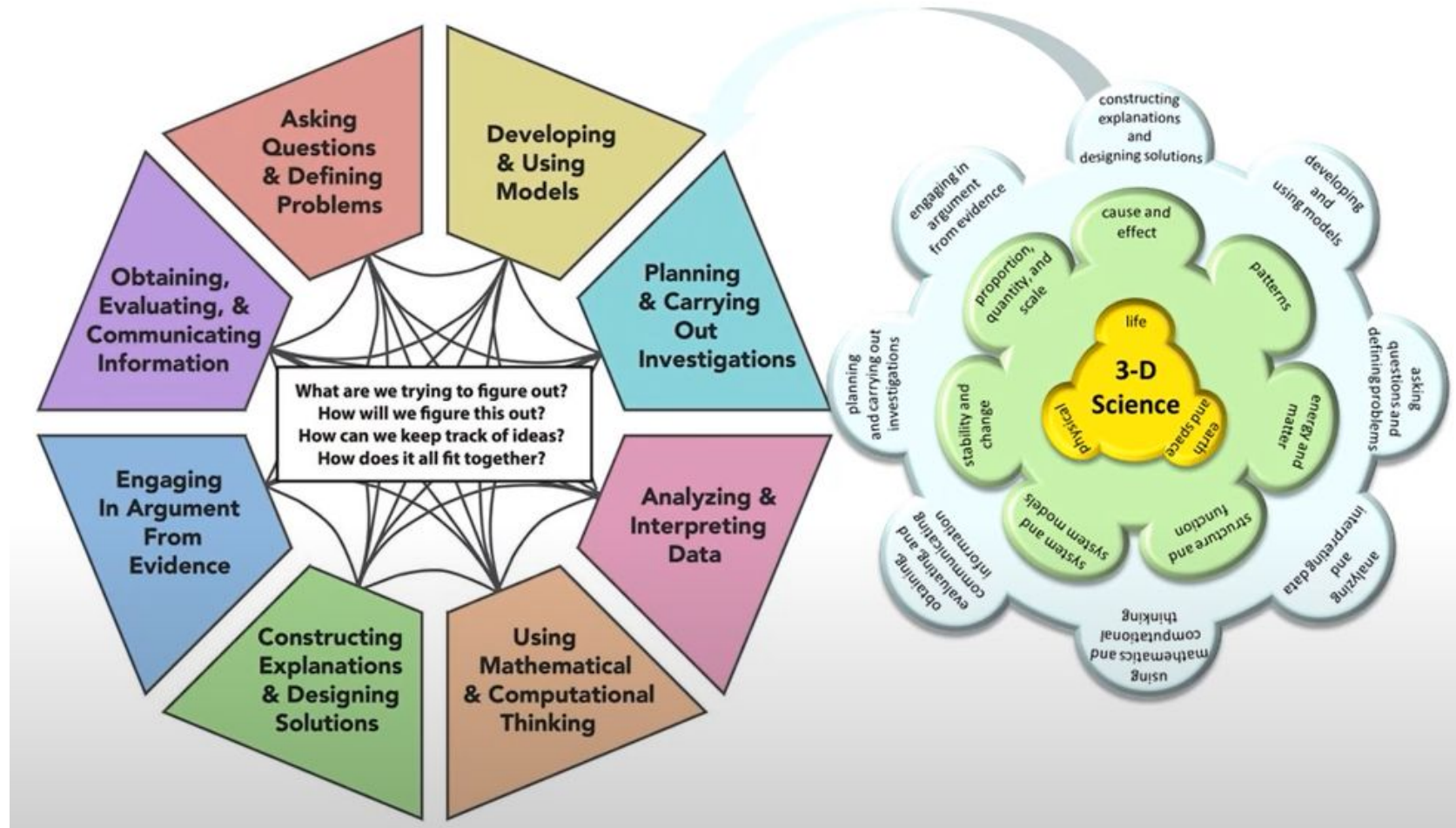
Science and Engineering Practices

Crosscutting Concepts

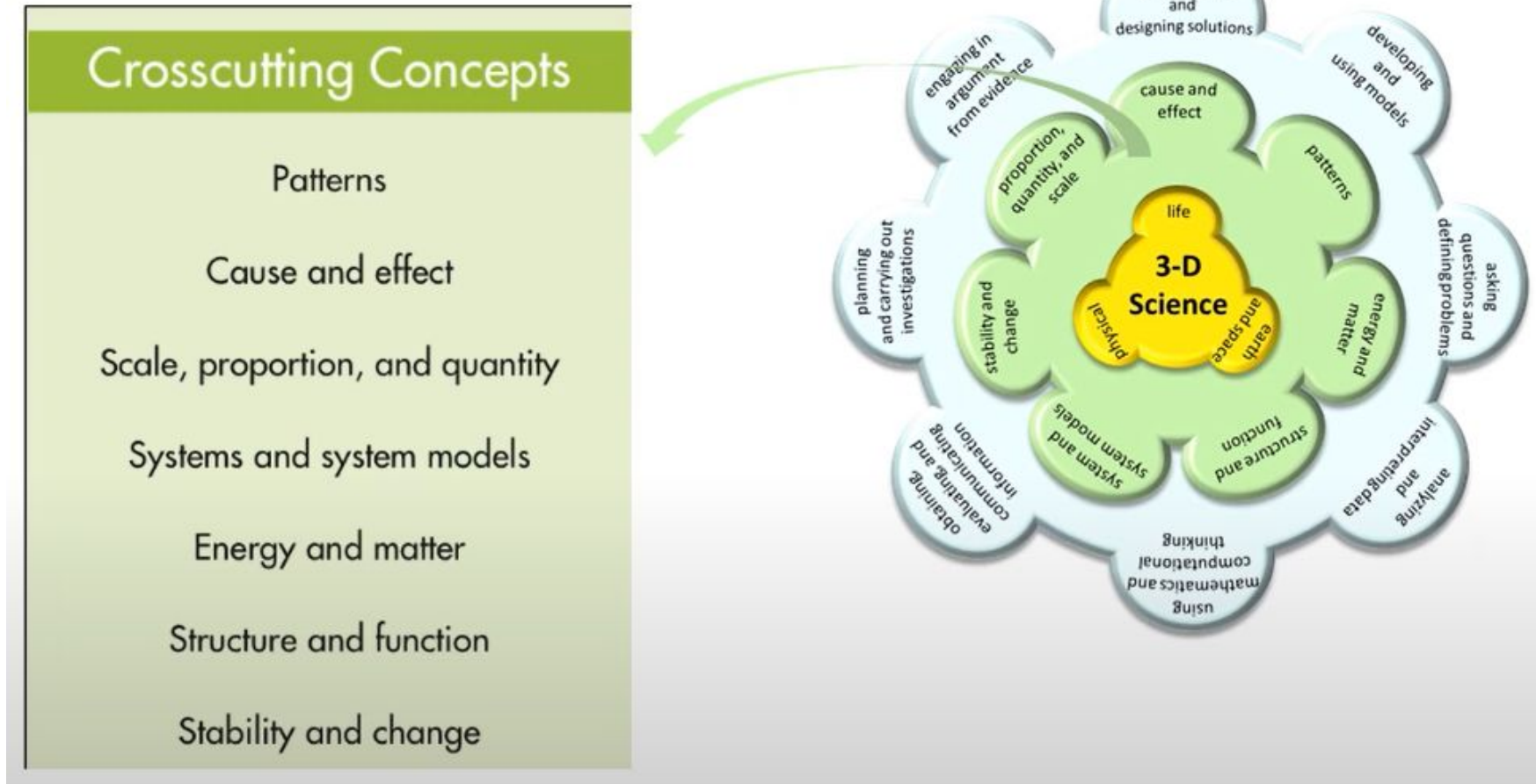
Disciplinary Core Ideas



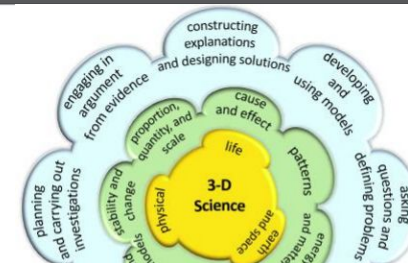
Science and Engineering Practices



Crosscutting Concepts



Core Ideas



Core Ideas for Knowing Science

Physical Science

- P1: All matter in the Universe is made of very small particles.
- P2: Objects can affect other objects at a distance.
- P3: Changing the movement of an object requires a net force to be acting on it.
- P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.

Earth and Space Science

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

Life Science

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

***Adapted from *Working with Big Ideas in Science Education*²**

Core Ideas for Using Science

- U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.
- U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products.
- U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.

Distribution of Core Ideas of Knowing Science Across All Grade Levels

Knowing Science	Knowing Science	K	1	2	3	4	5	6	7	8	HS
P1 Physical Science	All matter in the Universe is made of very small particles.										
P2: Physical Science	Objects can affect other objects at a distance.										
P3: Physical Science	Changing the movement of an object requires a net force to be acting on it.										
P4: Physical Science	The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.										

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

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

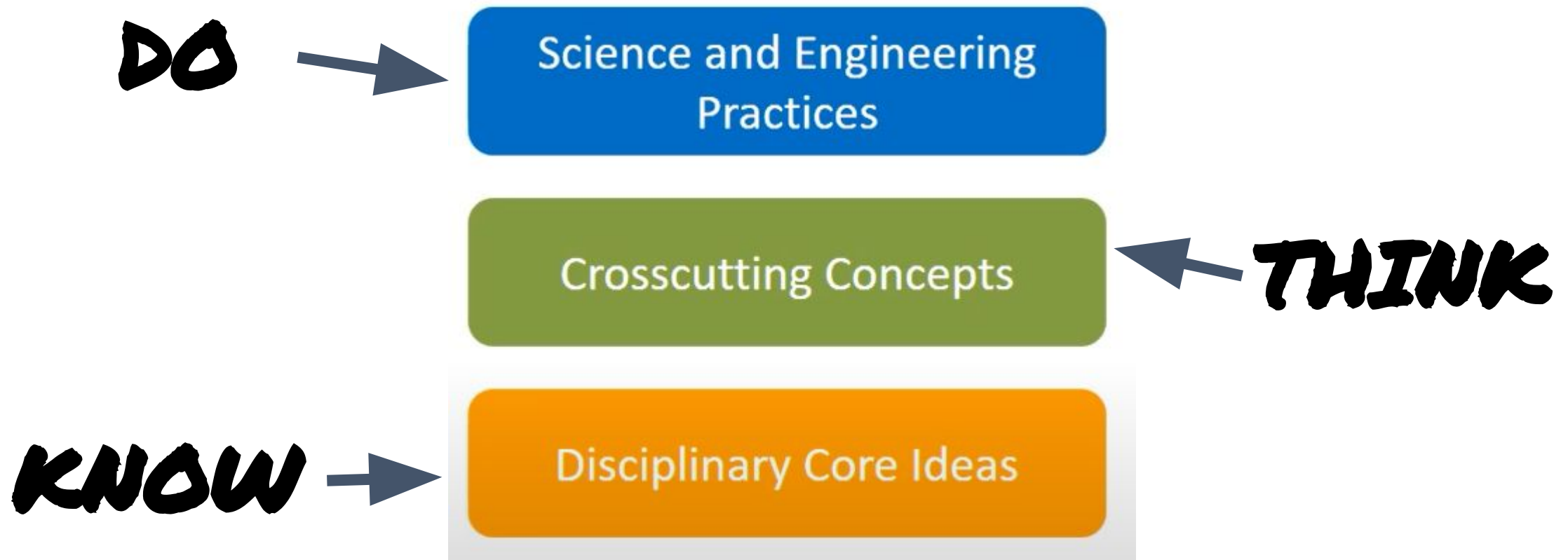
3-Dimensional Teaching and Learning One-Pager

3-Dimensions of Teaching and Learning Science

Science and Engineering Practices	Crosscutting Concepts
- ask questions and define problems - develop and use models - plan and carry out investigations - analyze and interpret data - use mathematics and computational thinking - construct explanations and design solutions - engage in argument from evidence - obtain, evaluate, and communicate information	- patterns - cause and effect - structure and function - systems and system models - stability and change - scale, proportion, and quantity - energy and matter
Core Ideas	
Core Ideas for Knowing Science	Core Ideas for Using Science
<u>Physical Science</u> P1: All matter in the Universe is made of very small particles. P2: Objects can affect other objects at a distance. P3: Changing the movement of an object requires a net force to be acting on it. P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event. <u>Earth and Space Science</u> E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate. E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe. <u>Life Science</u> L1: Organisms are organized on a cellular basis and have a finite life span. L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms. L3: Genetic information is passed down from one generation of organisms to another. L4: The unity and diversity of organisms, living and extinct, is the result of evolution.	U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised. U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products. U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.

Arizona Science Standards, Arizona Department of Education [LINK](#)

3 Dimensions of Teaching and Learning Science



Phenomena

What students
OBSERVE about
the natural or
manmade world

What students
DO to make
sense of
phenomena

Science and Engineering Practices

What students
KNOW...the
scientific
concepts
explaining the
phenomena

Disciplinary Core Ideas

Crosscutting Concepts

How students
THINK about
phenomena in
'big picture'
ideas that cross
all science
domains...the
bridge to other
disciplines

2004 AZ Standards vs. 2018 AZ Standards

2004 Adopted Standard	2018 Adopted Standard
6.3.PO1 Explain that sunlight is the major source of energy for most ecosystems.	6.L2U1.14 Construct a model that shows the cycling of matter and flow of energy in ecosystems. Crosscutting Concepts: Patterns; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter;
No further clarification provided	Background information provided in the standards document and further clarification provided in Elements document.

Less Of...More Of

ADE Resource:

Instructional Shifts: A New Vision for Science Education

Printed on purple paper

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/18801/guide-to-implementing-the-next-generation-science-standards>

ADE Standards Placemats

Side 1: 28 Essential Standards

Side 2: 3 Dimensions of Science

Arizona Science Standards - High School Essential Standards			
Physical Science Standards		Earth and Space Science Standards	
HS.P1U.1	Develop and use models to explain the relationship of the structure of atoms to patterns and properties observed within the Periodic Table and describe how these models are revised with new evidence.	HS.E1U.11	Analyze and interpret data to determine how energy from the Sun affects weather patterns and climate.
HS.P1U.2	Develop and use models for the transfer or sharing of electrons to predict the formation of ions, molecules, and compounds in both natural and synthetic processes.	HS.E1U.12	Develop and use models of the Earth that explain the role of energy and matter in Earth's constantly changing internal and external systems (geosphere, hydrosphere, atmosphere, biosphere).
HS.P1U.3	Ask questions, plan, and carry out investigations to explore the cause and effect relationship between reaction rate factors.	HS.E1U.13	Evaluate explanations and theories about the role of energy and matter in geologic changes over time.
HS.P1U.4	Obtain, evaluate, and communicate information about how the use of chemistry-related technologies have had positive and negative ethical, social, economic, and/or political implications.	HS.E1U.14	Engage in argument from evidence about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other.
HS.P2U.5	Construct an explanation for a field's strength and influence on an object (electric, gravitational, magnetic).	HS.E2U.15	Construct an explanation based on evidence to illustrate the role of nuclear fusion in the life cycle of a star.
HS.P3U.6	Collect, analyze, and interpret data regarding the change in motion of an object or system in one dimension, to construct an explanation using Newton's Laws.	HS.E2U.16	Construct an explanation of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings.
HS.P3U.7	Use mathematics and computational thinking to explain how Newton's laws are used in engineering and technologies to create products to serve human ends.	HS.E2U.17	Construct an explanation of the origin, expansion, and scale of the universe based on astronomical evidence.
HS.P4U.8	Engage in argument from evidence that the net change of energy in a system is always equal to the total energy exchanged between the system and the surroundings.		
HS.P4U.9	Engage in argument from evidence regarding the ethical, social, economic, and/or political benefits and liabilities of energy usage and transfer.		
HS.P4U.10	Construct an explanation about the relationships among the frequency, wavelength, and speed of waves traveling in various media, and their applications to modern technology.		
		Life Science Standards	
		HS.L2U.18	Obtain, evaluate, and communicate about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem.
		HS.L2U.19	Develop and use models that show how changes in the transfer of matter and energy within an ecosystem and interactions between species may affect organisms and their environment.
		HS.L1U.20	Ask questions and/or make predictions based on observations and evidence to demonstrate how cellular organization, structure, and function allow organisms to maintain homeostasis.
		HS.L2U.21	Obtain, evaluate, and communicate data showing the relationship of photosynthesis and cellular respiration; flow of energy and cycling of matter.
		HS.L1U.22	Construct an explanation for how cellular division (mitosis) is the process by which organisms grow and maintain complex, interconnected systems.
		HS.L1U.23	Obtain, evaluate, and communicate the ethical, social, economic and/or political implications of the detection and treatment of abnormal cell function.
		HS.L3U.24	Construct an explanation of how the process of sexual reproduction contributes to genetic variation.
		HS.L3U.25	Obtain, evaluate, and communicate information about the causes and implications of DNA mutation.
		HS.L3U.26	Engage in argument from evidence regarding the ethical, social, economic, and/or political implications of a current genetic technology.
		HS.L4U.27	Obtain, evaluate, and communicate evidence that describes how changes in frequency of inherited traits in a population can lead to biological diversity.
		HS.L4U.28	Gather, evaluate, and communicate multiple lines of empirical evidence to explain the mechanisms of biological evolution.

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Released 11/03/2022



Arizona Science Standards - High School Essential Standards	
Three Dimensions of Science Sensemaking in science occurs with the integration of three essential dimensions.	
Science and Engineering Practices The science and engineering practice describe a robust process for how scientists investigate and build models and theories of the natural world or how engineers design and build systems.	
- ask questions and define problems - develop and use models - plan and carry out investigations - analyze and interpret data	- use mathematics and computational thinking - construct explanations and design solutions - engage in argument from evidence - obtain, evaluate, and communicate information
Crosscutting Concepts Crosscutting concepts cross boundaries between science disciplines and provide an organizational framework to connect knowledge from various disciplines into a coherent and scientifically based view of the world. They build bridges between science and other disciplines and connect core ideas and practices throughout the fields of science and engineering. Their purpose is to provide a lens to help students deepen their understanding of the core ideas as they make sense of phenomena in the natural and designed worlds.	
- patterns - cause and effect - structure and function - systems and system models	- stability and change - scale, proportion, and quantity - energy and matter
Core Ideas Core Ideas for Knowing Science	
Physical Science Physical science encompasses physical and chemical sub-processes that occur within systems. At the high school level, students gain an understanding of these processes at both the micro and macro levels through the intensive study of matter, energy, and forces. P1: All matter in the Universe is made of very small particles. P2: Objects can affect other objects at a distance. P3: Changing the movement of an object requires a net force to be acting on it. P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.	Life Science Life science focuses on the patterns, processes, and relationships of living organisms. The standards for life science encompass the areas of cells and organisms; ecosystems, interactions, energy and dynamics; heredity; and biological diversity. L1: Organisms are organized on a cellular basis and have a finite life span. L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms. L3: Genetic information is passed down from one generation of organisms to another. L4: The unity and diversity of organisms, living and extinct, is the result of evolution.
Earth and Space Science Earth and space science encompass processes that occur on Earth while also addressing Earth's place within our solar system and galaxy. At the high school level, students gain an understanding of these processes through a wide scale: unimaginably large to invisibly small. ¹ Earth and Space Sciences, more than any other discipline, are rooted in other scientific disciplines. Students, through the close study of earth and space, will find clear applications for their knowledge of gravitation, energy, magnetism, cycles, and biological processes. E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate. E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.	
Core Ideas for Using Science The three core ideas for Using Science connect scientific principles, theories, and models; engineering and technological applications; and societal implications to the content knowledge to support that understanding.	
U1: Scientists explain phenomena using evidence obtained from observations and/or scientific investigations. Evidence may lead to developing models and/or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised. U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products. U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.	
Phenomena are observable events that can be explained or explored. Science aims to explain the causes of these events, or phenomena, using scientific ideas, concepts, and practices (3-dimensions).	

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Released 11/03/2022



★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.

Earth and Space – E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe. Earth and the Solar System. Essential standards are standards that will be assessed on the state exam and are intended for ALL students to have learned by the end of 3 credits of high school science courses.

Essential HS.E2U1.16

Construct an explanation of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings.

Earth and space Plus (+) Standards HS+E are supporting standards designed to be used with the essential standards for students taking a high school earth and space (E) course.

Plus HS+E.E2U1.13

Analyze and interpret data showing how gravitational forces are influenced by mass, and the distance between objects.

Plus HS+E.E2U1.14

Use mathematics and computational thinking to explain the movement of planets and objects in the solar system.

Crosscutting Concepts & Background Information for Educators

Crosscutting Concepts:

Patterns; Cause and Effect; Scale, Proportion and Quantity; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change⁴

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. 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. Gravity holds Earth in orbit around the sun, and it holds the moon in orbit around Earth. 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. Cyclical changes in the shape of Earth’s orbit around the sun, together with changes in the orientation of the planet’s axis of rotation, both occurring over tens to hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on Earth. These phenomena cause cycles of ice ages and other gradual climate changes. ⁴ (p. 176)

SUSD Course Placemats



Arizona Essential Standards: Oceanography/Astronomy

Earth and Space Science Standards		Earth and Space Science Standards		Earth and Space Science Standards	
★HS.E1U1.11	Analyze and interpret data to determine how energy from the Sun affects weather patterns and climate.	★HS.E1U3.14	Engage in argument from evidence about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other.	★HS.E2U1.17	Construct an explanation of the origin, expansion, and scale of the universe based on astronomical evidence.
HS+E.E1U1.1	Construct an explanation based on evidence for how the Sun's energy transfers between Earth's systems.	HS+E.E1U3.9	Construct an explanation, based on evidence, for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.	HS+E.E2U1.15	Obtain, evaluate, and communicate information on how the nebular theory explains solar system formation with distinct regions characterized by different types of planetary and other bodies.
HS+E.E1U1.2	Develop and use models to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.	HS+E.E1U3.10	Ask questions, define problems, and evaluate a solution to a complex problem, based on prioritized criteria and tradeoffs, that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.	HS+E.E2U1.16	Obtain, evaluate, and communicate information about patterns of size and scale of our solar system, our galaxy, and the universe.
HS+E.E1U1.3	Analyze geoscience data and the results from global climate models to make evidence-based predictions of current rate and scale of global or regional climate changes.	HS+E.E1U3.11	Develop and use a quantitative model to illustrate the relationship among Earth systems and the degree to which those relationships are being modified due to human activity.	HS+E.E2U2.17	Obtain, evaluate, and communicate the impact of technology on human understanding of the formation, scale, and composition of the universe.
★HS.E1U1.12	Develop and use models of the Earth that explains the role of energy and matter in Earth's constantly changing internal and external systems (geosphere, hydrosphere, atmosphere, biosphere).	★HS.E2U1.15	Construct an explanation based on evidence to illustrate the role of nuclear fusion in the life cycle of a star.	Physical Science Standards	
HS+E.E1U1.4	Analyze and interpret geoscience data to make the claim that dynamic interactions with Earth's surface can create feedbacks that cause changes to other Earth systems.	HS+E.E2U1.12	Obtain, evaluate, and communicate scientific information about the way stars, throughout their stellar stages, produce elements and energy.	★HS.P2U1.5	Construct an explanation for a field's strength and influence on an object (electric, gravitational, magnetic).
HS+E.E1U1.5	Obtain, evaluate, and communicate information on the effect of water on Earth's materials, surface processes, and groundwater systems.	★HS.E2U1.16	Construct an explanation of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings.	★HS.P3U2.7	Use mathematics and computational thinking to explain how Newton's laws are used in engineering and technologies to create products to serve human ends.
★HS.E1U1.13	Evaluate explanations and theories about the role of energy and matter in geologic changes over time.	HS+E.E2U1.13	Analyze and interpret data showing how gravitational forces are influenced by mass, and the distance between objects.	★HS.P4U1.8	Engage in argument from evidence that the net change of energy in a system is always equal to the total energy exchanged between the system and the surroundings.
HS+E.E1U1.6	Obtain, evaluate, and communicate information of the differences in age, structure, and composition of Earth's crust.	HS+E.E2U1.14	Use mathematics and computational thinking to explain the movement of planets and objects in the solar system.	★HS.P4U1.10	Construct an explanation about the relationships among the frequency, wavelength, and speed of waves traveling in various media, and their applications to modern technology.
HS+E.E1U1.7	Engage in argument from evidence of ancient Earth materials, meteorites, and other planetary surfaces to explain Earth's formation and early history.	Life Science Standards		★HS.L2U3.18	Obtain, evaluate, and communicate about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem.
HS+E.E1U1.8	Develop and use models to illustrate how Earth's internal and surface processes operate over time to form, modify, and recycle continental and ocean floor features.				

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The elements are not to be used as a check-off list, but rather a useful tool to help educators identify the specific pieces of knowledge and skill that make up the practice, crosscutting concept, or core idea at that grade-band.

Arizona Essential Standards: Oceanography/Astronomy

Earth and Space Science Standards	Earth and Space Science Standards	Earth and Space Science Standards
★HS.E1U1.11 Analyze and interpret data to determine how energy from the Sun affects weather patterns and climate. HS+E.E1U1.1 Construct an explanation based on evidence for how the Sun's energy transfers between Earth's systems. HS+E.E1U1.2 Develop and use models to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. HS+E.E1U1.3 Analyze geoscience data and the results from global climate models to make evidence-based predictions of current rate and scale of global or regional climate changes. ★HS.E1U1.12 Develop and use models of the Earth that explains the role of energy and matter in Earth's constantly changing internal and external systems (geosphere, hydrosphere, atmosphere, biosphere). HS+E.E1U1.4 Analyze and interpret geoscience data to make the claim that dynamic interactions with Earth's surface can create feedbacks that cause changes to other Earth systems. HS+E.E1U1.5 Obtain, evaluate, and communicate information on the effect of water on Earth's materials, surface processes, and groundwater systems. ★HS.E1U1.13 Evaluate explanations and theories about the role of energy and matter in geologic changes over time. HS+E.E1U1.6 Obtain, evaluate, and communicate information of the differences in age, structure, and composition of Earth's crust. HS+E.E1U1.7 Engage in argument from evidence of ancient Earth materials, meteorites, and other planetary surfaces to explain Earth's formation and early history. HS+E.E1U1.8 Develop and use models to illustrate how Earth's internal and surface processes operate over time to form, modify, and recycle continental and ocean floor features.	★HS.E1U3.14 Engage in argument from evidence about the availability of natural resources, occurrence of natural hazards, changes in climate, and human activity and how they influence each other. HS+E.E1U3.9 Construct an explanation, based on evidence, for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. HS+E.E1U3.10 Ask questions, define problems, and evaluate a solution to a complex problem, based on prioritized criteria and tradeoffs, that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. HS+E.E1U3.11 Develop and use a quantitative model to illustrate the relationship among Earth systems and the degree to which those relationships are being modified due to human activity. ★HS.E2U1.15 Construct an explanation based on evidence to illustrate the role of nuclear fusion in the life cycle of a star. HS+E.E2U1.12 Obtain, evaluate, and communicate scientific information about the way stars, throughout their stellar stages, produce elements and energy. ★HS.E2U1.16 Construct an explanation of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings. HS+E.E2U1.13 Analyze and interpret data showing how gravitational forces are influenced by mass, and the distance between objects. HS+E.E2U1.14 Use mathematics and computational thinking to explain the movement of planets and objects in the solar system.	★HS.E2U1.17 Construct an explanation of the origin, expansion, and scale of the universe based on astronomical evidence. HS+E.E2U1.15 Obtain, evaluate, and communicate information on how the nebular theory explains solar system formation with distinct regions characterized by different types of planetary and other bodies. HS+E.E2U1.16 Obtain, evaluate, and communicate information about patterns of size and scale of our solar system, our galaxy, and the universe. HS+E.E2U2.17 Obtain, evaluate, and communicate the impact of technology on human understanding of the formation, scale, and composition of the universe. Physical Science Standards ★HS.P2U1.5 Construct an explanation for a field's strength and influence on an object (electric, gravitational, magnetic). ★HS.P3U2.7 Use mathematics and computational thinking to explain how Newton's laws are used in engineering and technologies to create products to serve human ends. ★HS.P4U1.8 Engage in argument from evidence that the net change of energy in a system is always equal to the total energy exchanged between the system and the surroundings. ★HS.P4U1.10 Construct an explanation about the relationships among the frequency, wavelength, and speed of waves traveling in various media, and their applications to modern technology. Life Science Standards ★HS.L2U3.18 Obtain, evaluate, and communicate about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem.

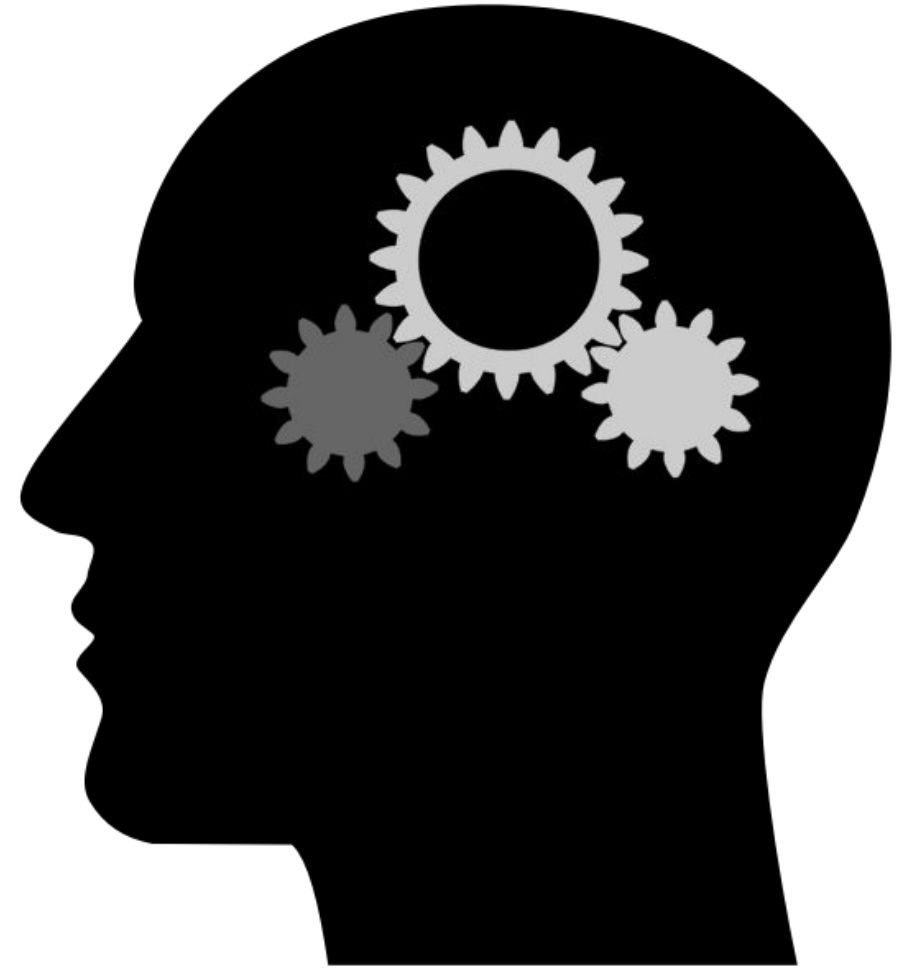
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Looking at the Standards

As you take a closer look at the standards covered in the courses/units for which you are reviewing materials, think about and discuss:

- What do students need to DO?
- What do students need to KNOW?
- How would students demonstrate their understanding of that standard?



Student Experience

- Make observations
- Ask questions
- Conduct an investigation
- Develop a model
- Communicate the results of an investigation
- Engage in argument from evidence
- Obtain information from multiple sources
- Construct an explanation

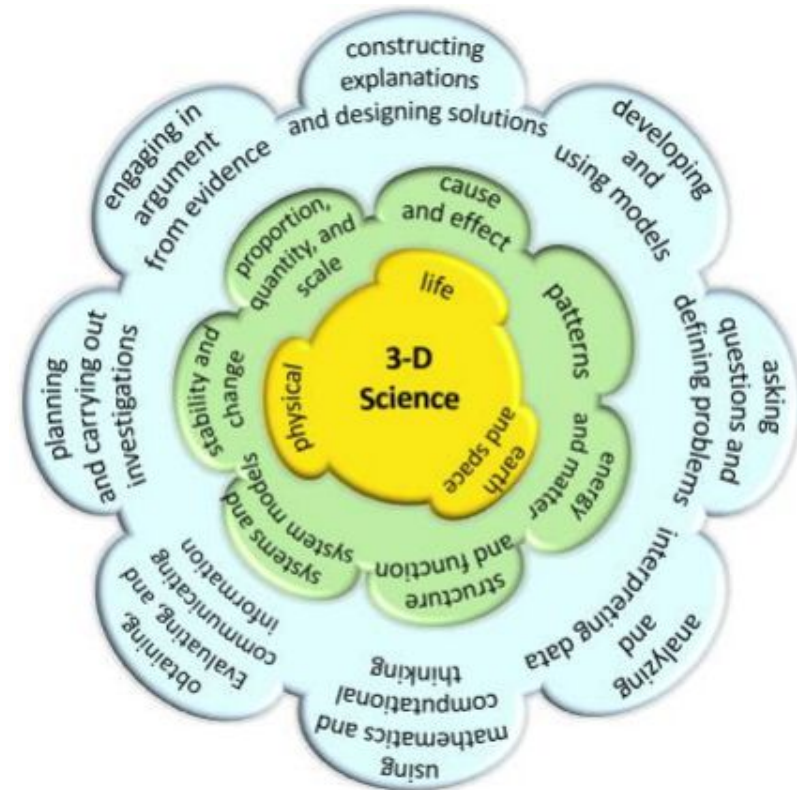
AZSS vs. NGSS

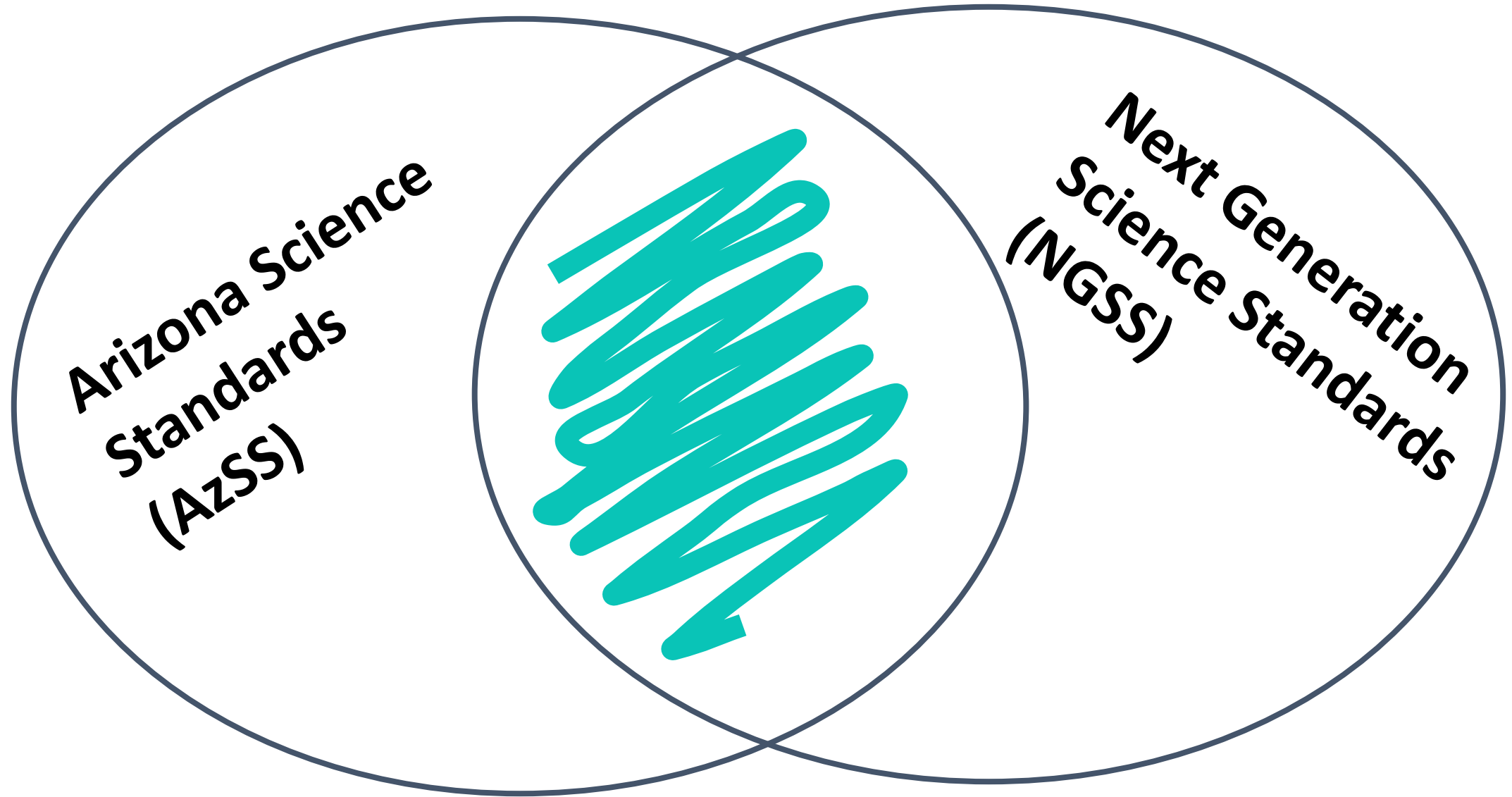
AZSS: Three Dimensions of Teaching and Learning Science

Science and Engineering Practices

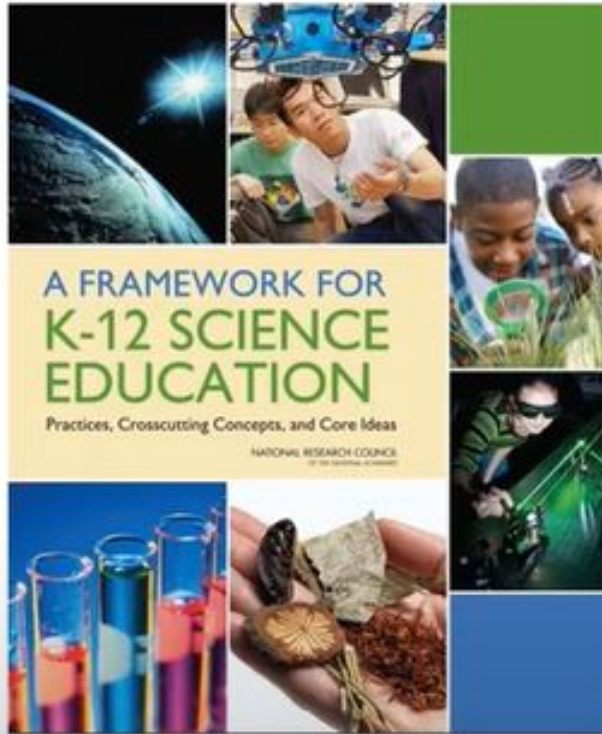
Crosscutting Concepts

Disciplinary Core Ideas





NGSS



AzSS

Working with **Big Ideas** of Science Education

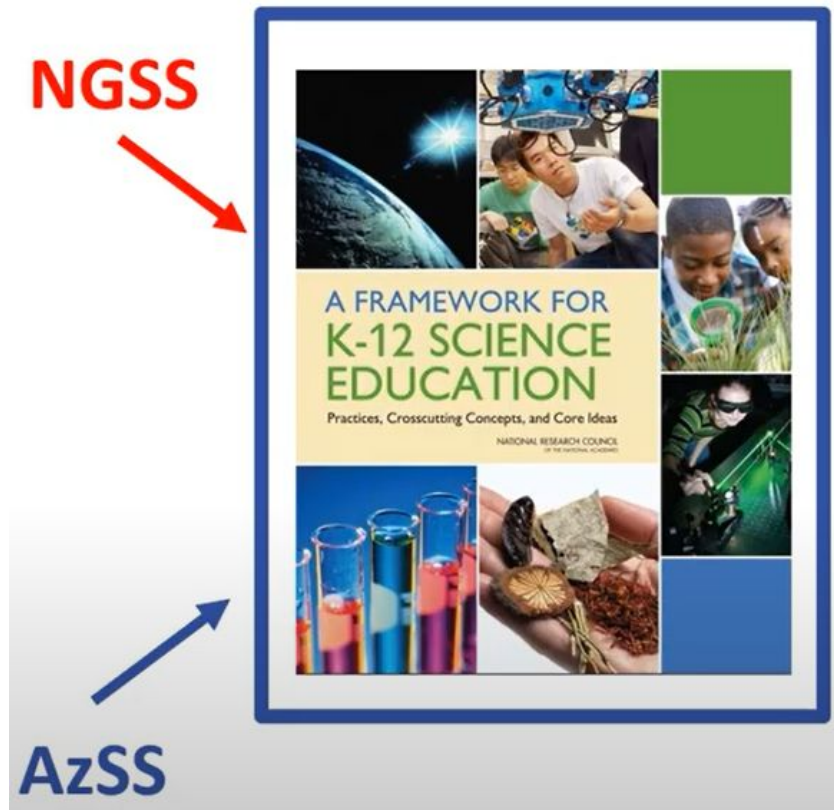
Edited by Wynne Harlen

with Derek Bell, Rosa Daniels, Hubert Dyson,
Guillermo Fernández de la Campa, Wayne Laine,
Robin Miller, Michael Reiss, Patricia Rowell and Wei Yu



AzSS

What is the **SAME** between AZSS and NGSS?



Three-Dimensional Learning

- Science and Engineering Practices
- Crosscutting Concepts
- ~~Disciplinary Core Ideas~~

Phenomena Drives Instruction

What is **DIFFERENT** between AZSS and NGSS?

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
1. Asking questions & defining problems 2. Developing & using models 3. Planning & carrying out investigations 4. Analyzing & interpreting data 5. Using mathematics & computational thinking 6. Constructing explanations & designing solutions 7. Engaging in argument from evidence 8. Obtaining, evaluating, & communicating information	Physical Science PS 1: Matter & its interactions PS 2: Motion & stability: Forces & interactions PS 3: Energy PS 4: Waves & their applications; technologies for information transfer Life Sciences LS 1: From molecules to organisms: structures & processes LS 2: Ecosystems: interactions, energy, & dynamics LS 3: Heredity: inheritance & variation LS 4: Biological evolution: Unity & diversity Earth & Space Sciences ESS 1: Earth's place in the universe ESS 2: Earth's systems ESS 3: Earth & human activity Engineering, Technology, & the Application of Science ETS 1: Engineering design ETS 2: Links among engineering, technology, science, & society	1. Patterns 2. Cause & effect 3. Scale, proportion, & quantity 4. Systems & system models 5. Energy & matter 6. Structure & function 7. Stability & change

SAME

DIFFERENT

SAME

What is DIFFERENT between AZSS and NGSS Core Ideas?

NGSS

Disciplinary Core Ideas

Physical Science

PS 1: Matter & its interactions

PS 2: Motion & stability: Forces & interactions

PS 3: Energy

PS 4: Waves & their applications in technologies for information transfer

Life Sciences

LS 1: From molecules to organisms: structures & processes

LS 2: Ecosystems: Interactions, energy, & dynamics

LS 3: Heredity: Inheritance & variation of traits

LS 4: Biological evaluation: Unity & diversity

Earth & Space Sciences

ESS 1: Earth's place in the universe

ESS 2: Earth's systems

ESS 3: Earth & human activity

Engineering, Technology, & the Application of Science

ETS 1: Engineering design

ETS 2: Links among engineering, technology, science, & society

AZSS

Core Ideas for Knowing Science

Physical Science

P1: All matter in the Universe is made of very small particles.

P2: Objects can affect other objects at a distance.

P3: Changing the movement of an object requires a net force to be acting on it.

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

Earth and Space Science

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

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

Life Science

L1: Organisms are organized on a cellular basis and have a finite life span.

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

L3: Genetic information is passed down from one generation of organisms to another.

L4: The unity and diversity of organisms, living and extinct, is the result of evolution.

**Adapted from Working with Big Ideas in Science Education²*

Core Ideas for Using Science

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

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

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

NGSS

**Disciplinary
Core ideas**

BOTH

***K-12 Framework for
Science Education***

3-Dimensional

**Science & Engineering
Practices**

Crosscutting Concepts

Phenomena-Based

AzSS

Core Ideas

**Also incorporates
research from
*Working with Big
Ideas of Science
Education***

****Locations of SEPs and Core Ideas vary by grade level****

Example Standards- Physical Science

NGSS

Students who demonstrate understanding can:

- MS-PS1-1.** Develop models to describe the atomic composition of simple molecules and extended structures. *[Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure is not required.]*

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to predict and/or describe phenomena.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms.
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).

Crosscutting Concepts

Scale, Proportion, and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

AzSS

Physical Science Standards	Learning Progressions, Key Terms, and Crosscutting Concepts
8.P1U1.1	
Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved.	All materials, anywhere in the universe, living and non-living, are made of a very large numbers of basic 'building blocks' called atoms , of which there are about 100 different kinds. Substances made of only one kind of atom are called elements . Atoms of different elements can ~~combine together~~ to form a very large number of compounds . A chemical reaction involves a rearrangement of the atoms in the reacting substances to form new substances, while the total amount of matter remains the same. The properties of different materials can be explained in terms of the behavior of the atoms and groups of atoms of which they are made. ² (p. 20)
8.P1U1.2	
Obtain and evaluate information regarding how scientists identify substances based on unique physical and chemical properties.	Crosscutting Concepts: patterns; cause and effect ; scale, proportion and quantity; systems and system models; energy and matter ; stability and change ; structure and function ⁴

Example Standards- Side by Side

	NGSS	AzSS
Coding:	MS-PS1-1 ✓	8.P1U1.1 ✓
Standard:	Develop models to describe the atomic composition of simple molecules and extended structures. ✓	Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved. ✓
Science & Engineering Practice:	Develop Models ✓	Develop and Use Models ✓
Core Idea:	PS1.A: Structure & Properties of Matter Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). ✓	P1: All matter in the Universe is made of very small particles. 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. ✓
Crosscutting Concept:	Scale, Proportion, & Quantity ✓	Any of the 7 Crosscutting Concepts, suggested: Cause & Effect, Stability & Change, Energy & Matter ✓



Example Standards- Side by Side

	NGSS	AzSS
Coding:	5-LS2-1 ✗	3.L2U1.8 ✗
Standard:	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. ✗	Construct an argument from evidence that organisms are interdependent. ✗
Science & Engineering Practice:	Develop a Model ✗	Construct an argument ✗
Core Idea:	LS2.A: Interdependent Relationships in Ecosystems The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. [omitted the rest] ✓	L2: Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms. 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. ✓
Crosscutting Concept:	Systems & System Models ✓	Any of the 7 Crosscutting Concepts, suggested: Systems and System Models, Structure and Function ✓



Why is this important to know and understand?

Arizona's Science Standards Summary

AzSS vs. NGSS Planning Guide – K-12

Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – K-12

Standards, Curriculum, Instruction, and Assessment

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

Curriculum - The resources used for teaching and learning the standards. Curricula are adopted at a local level by districts and schools. Curricula include scope and sequence of K-12 standards and/or learning objectives/targets aligned to the state standards. Comprehensive curricula are necessary to plan the pace of instruction, alignment standards and grade level expectations horizontally and vertically, set district assessment and professional development calendars and guide teachers as they deliver instruction.

Instruction - The methods and processes used by teachers in planning, instruction and assessment. Instructional techniques are employed by individual teachers in response to the needs of the students in their classes to help them progress through the curriculum in order to master the standards.

Assessment - The process of gathering information about student learning to inform education-related decisions. Assessments can reflect a wide variety of learning goals/targets using a range of methods serving many important users and uses at a variety of levels from the classroom to the boardroom. In this sense, assessment is an essential part of informing the teaching and learning process.

Innovations for 2018 Science Standards

1. **Three-Dimensional Learning:** An instructional approach where students make sense of phenomena of the natural world through "engaging in science and engineering practices and their application of the crosscutting concepts" (Bybee pg. 2). The three dimensions work together by reinforcing inner-related concepts, giving students a way of organizing and applying their knowledge across a broad spectrum
2. **Explaining Phenomena and Designing Solutions to Problems:** Providing a context for lessons, units, and programs that spark students' curiosity about the phenomena of the natural world and provides a motivation to learn the core ideas of science. The content becomes meaningful, and students are engaged with learning the content to explain the phenomena or to design solutions to a problem.
3. **Incorporating Engineering Design:** Incorporating engineering design and nature of science are practiced and experienced by students throughout the Arizona Science Standard.
4. **Building K-12 Progression:** Science engineering practices, crosscutting concepts, and core ideas build coherent learning progressions both within a grade level and across grade levels so students can continually build on and revise their knowledge and skills throughout their schooling.
5. **Connecting to ELA/Literacy and Mathematics:** Literacy and mathematics are part of science. Integrating these disciplines with science provides broad and deep conceptual understanding in all three subject areas.

Sources:
 Bybee, R.W. (2015). *NGSS Innovations*. Retrieved from <https://www.amnh.org/content/download/133084/2214178/file/NGSS%20Innovations.pdf>
 Harlen, W. (2015). *Working with big ideas of science education*. Global Network of Science Academies (IAP) Science Education Programme: Trieste, Italy.
 Moulding, B.D., Bybee, R.W., Paulson, N. (2015). *A vision and plan for science teaching and learning*. USA: Essential Teaching and Learning Publications.
 National Research Council (NRC). (2012). *A Framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Washington, DC: The National Academies Press.
 Schwarz, C.V., Passmore, C., Reiser, B.J. (2017). *Helping students make sense of the world using next generation science and engineering practices*. Arlington, VA: NSTA Press
 What are NGSS Performance Expectations? (2017). Retrieved from <https://www.albert.io/blog/what-are-ngss-performance-expectations/>



The intention of this document is to help Arizona educators determine if a Next Generation Science Standard (NGSS) resource could be used when planning for instruction with the Arizona Science Standards (AzSS). This document describes how the Arizona Science Standards may or may not align to the Next Generation Science Standards.

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Alignment of the AzSS to NGSS Performance Expectations Note: An

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

[illegible]

Vendor Letter - Criteria

Vendor Letter - Criteria



Scottsdale *Unified* School District
Engaging all students in world-class, future-focused learning

SECONDARY SCIENCE CURRICULUM ADOPTION COMMITTEE

SUSD's VISION: Engaging all students in world-class, future-focused learning.

SUSD's MISSION: We inspire, motivate, and empower all to think critically, act collaboratively, and embrace diversity for a life of intellectual exploration, community engagement, and personal growth.

DRAFT Criteria for determining the quality of instructional materials include:

Accuracy and Alignment:

- Aligned to Arizona Science Standards (must provide an explicit AzSS alignment document).
- Aligned to course and exam content of AP courses (if applicable).
- Uses scientifically accurate and grade appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.
- Curriculum is research-based with supporting evidence.
- Designed so students make sense of phenomena and/or design solutions to problems by engaging students in 3-dimensional learning (Science and Engineering Practices, Crosscutting Concepts, and Core Ideas).
- When appropriate, links are made to AZ Science Standards in all the domains (life science, physical science, and Earth and space science). Core ideas from different disciplines are used together to explain phenomena.
- Curriculum is at least 20% laboratory/investigation-based (devoted to providing an opportunity for students to manipulate equipment, materials, or specimens to develop skills in observation and analysis, and to discover, demonstrate, illustrate, or test scientific principles or concepts).
- Appropriate lessons, investigations, and assessments that prepare students for high stakes assessments, performance-based tasks, and advanced coursework.

Engagement and the Ability to Meet Student Needs

- Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.
- Provides guidance and resources for teachers to differentiate instruction and assessment (both support and extensions).
- Questions and learning tasks encourage the development and application of critical and creative thinking.
- Problem-based learning and simulations relevant to the lives of students.
- Differentiation in each unit (content, process, product for readiness, language ability, learning style, etc.).
- Resources spark student interest and include interdisciplinary, real world connections.

Ease of Use and Support

- Layout and organization of curriculum materials contribute to ease of use.
- Resources are available in multiple formats for both students and teachers (hard-copy, digital, etc.). Digital resources can be accessed by teachers and students through SUSD's learning management systems (Clever, Google Classroom, Synergy, etc.).
- Curriculum is designed to link student engagement and knowledge across lessons and units and is arranged in a logical sequence.
- Curriculum provides supports to teachers that buttress student academic honesty.
- Scoring guidelines and rubrics are provided for assessments.
- Professional development is provided to support implementation of curriculum.

ADE Resources

Arizona Department of Education Resources

[Arizona Science Standards](#) webpage

Recorded Webinars and Videos (16 available)

- [Science Standards Overview Video](#)
- [Phenomenon-Based 3-Dimensional Instruction Video](#)
- [SEPs, CCCs, and Core Ideas: Putting the 3-Dimensions Together Video](#)

[ADE Guidance for Evaluating High Quality Instructional Science Materials Resource Page](#) and [Video](#)

And so much more!



Future Meetings

Next Meeting

Monday, October 30, 2023 from 3:30 - 5:30
at SUSD Oak Learning Campus 7501 E Oak St, Scottsdale, AZ 85257

Meeting adjourned!

