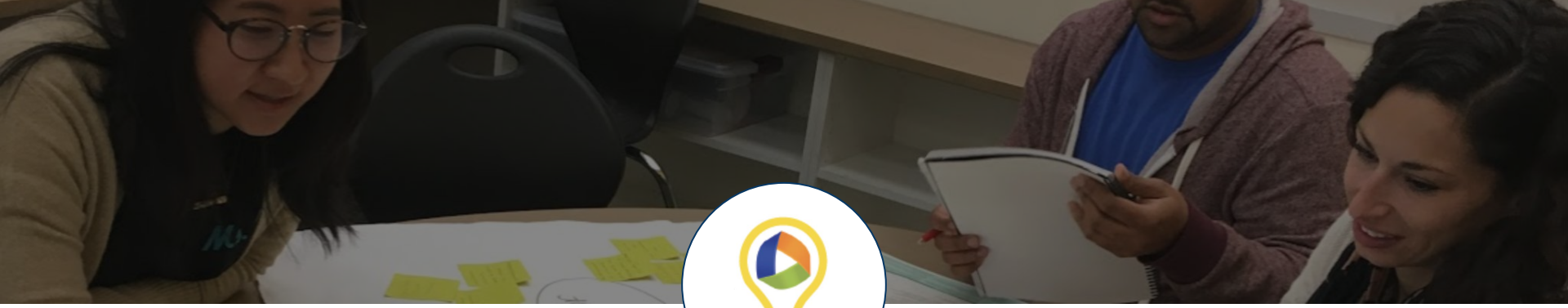


How the Next Generation Science Standards (NGSS) Change Science Teaching and Learning

Shifts and Engaging Practices that Support Student Sensemaking

Early STEAM Spring Seminar
February 15, 2024

Agenda

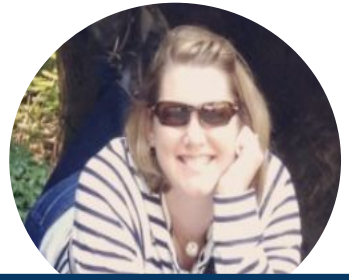
How are the Next Generation Science Standards (NGSS) changing classrooms?

- Introductions and overview
- Shifts at the heart of the science standards
- Practices that support student sensemaking in science
- What does this type of learning look like?

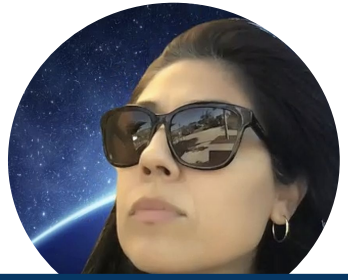
Agenda

How are the Next Generation Science Standards (NGSS) changing classrooms?

- Introductions and overview
- Shifts at the heart of the science standards
- Practices that support student sensemaking in science
- What does this type of learning look like?



Jill Grace



Andrea Frías

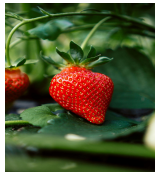
K-12 Alliance WestEd

NGSS EARLY IMPLEMENTERS WestEd

Our Work

Innovating science education that transforms learning, teaching, and leadership to empower all students

✨Sparking✨ science curiosity





Think about what sparked your curiosity in science as a child, what currently sparks your curiosity in science today, or even what sparks your child's curiosity.

Which image best represents that science spark?

Directions: Hop on the Padlet with others and:

- Find an image that best matches what you think sparks science curiosity or add your own!
  - Introduce yourself (who are you and where are you from)
  - Explain why you chose this image to represent your spark
- Interact with the posts of others by leaving comments or reaction

:Padlet

K-12 Alliance • 1m

What sparks science curiosity?

Introduce yourself, share your ideas and comment or react on others!

K-12 Alliance 24m

0 0

Add comment

K-12 Alliance 23m

0 0

Add comment

K-12 Alliance 23m

0 0

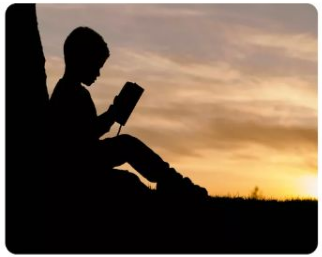
Add comment

K-12 Alliance 22m

0 0

Add comment

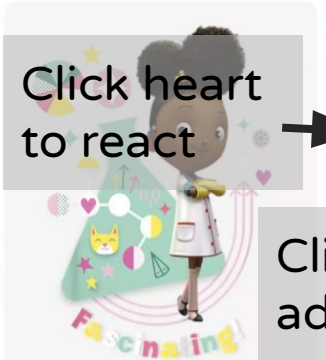
K-12 Alliance 22m



0 0

Add comment

K-12 Alliance 21m



Click heart to react

0 0

Add comment

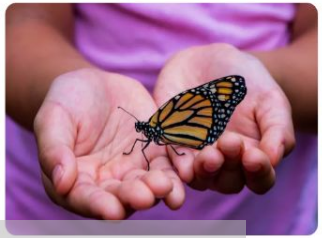
K-12 Alliance 21m

Click here to add comments

0 0

Add comment

K-12 Alliance 20m



0

Use the + icon to add images

Curiosity sensemaking

Agenda

How are the Next Generation Science Standards (NGSS) changing classrooms?

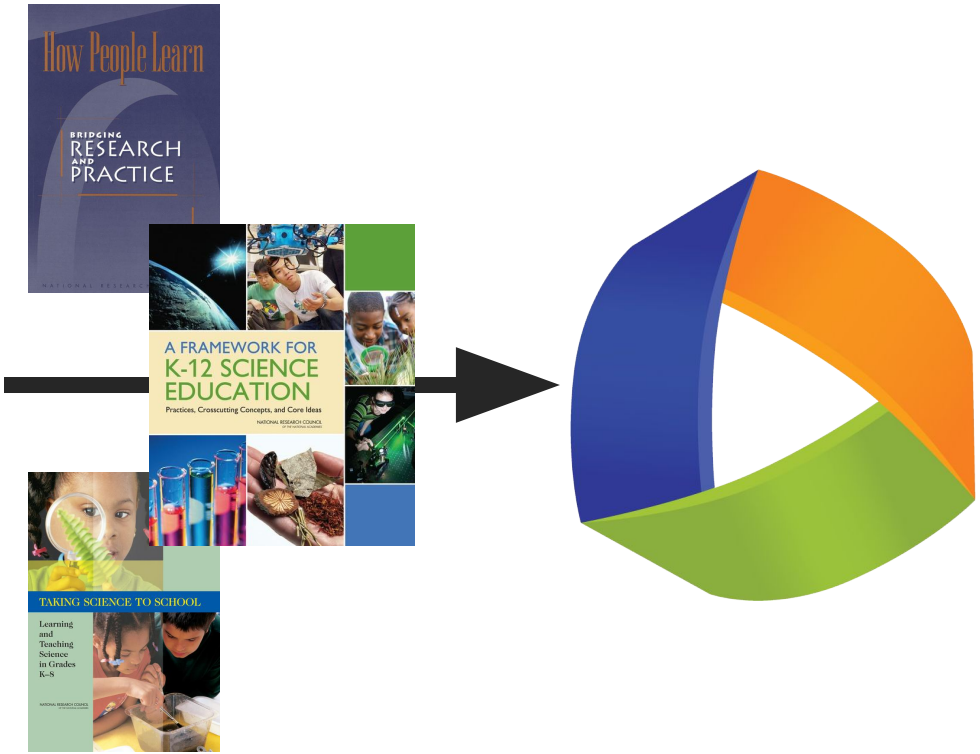
Introductions and overview

Shifts at the heart of the science standards

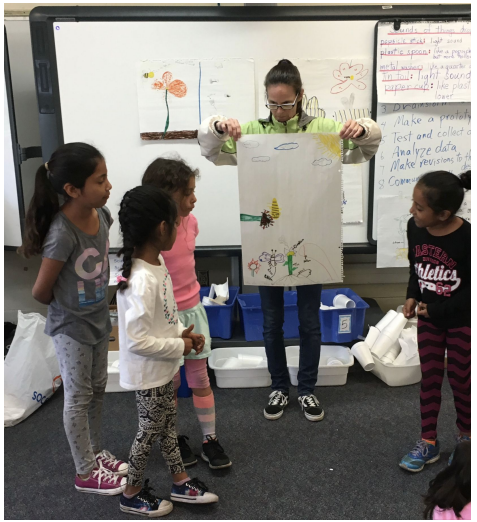
Practices that support student sensemaking in science

What does this type of learning look like?

Research Base

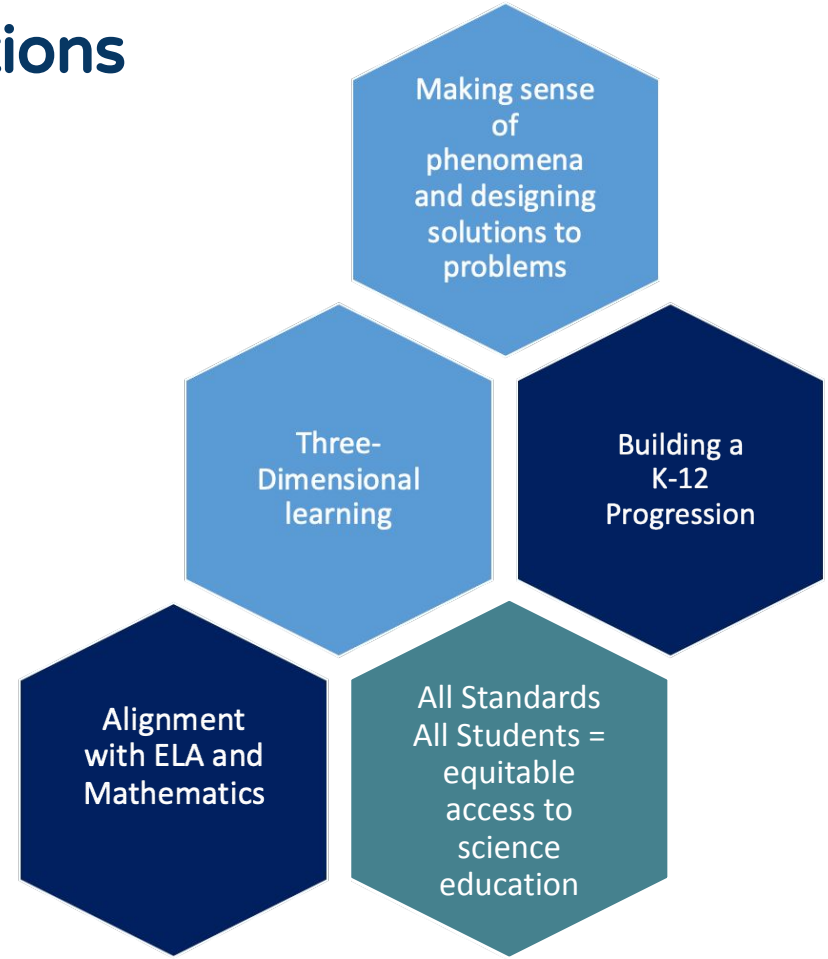


Resulting Shift

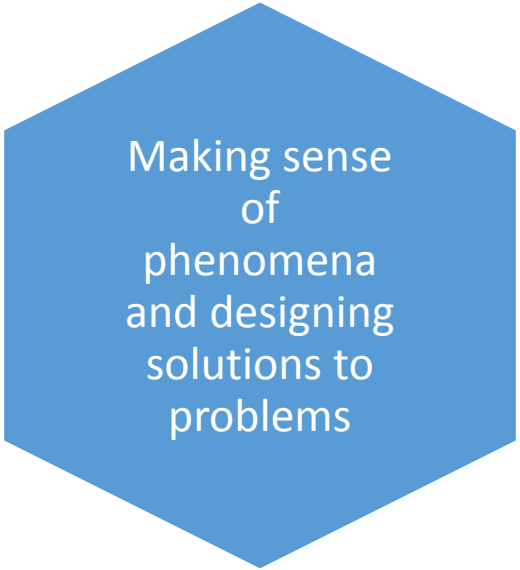


Shift from learning about science ideas
to figuring out and explaining phenomena and solving problems

Science Standard Innovations



Approximating how scientists and engineers understand our world



Making sense of phenomena and designing solutions to problems

The work that scientists do reflects who they are, what they care about, and how they experience the world. ***It should be no different for students.***

Bang, Brown, Calabrese Barton, Rosebery, & Warren 2017

Examples from

CA NGSS K-8 Early Implementation Initiative

Explaining Phenomena and Solving Problems

Making sense of phenomena and designing solutions to problems

Kindergarten Example:
Objects Do Not Move On Their Own

Movement is caused by pushes and pulls and can happen in different directions

1st Grade Example:
A fire truck siren uses sound to communicate

Sound causes matter to vibrate, sounds can communicate over a distance

2nd Grade Example:
The Crayons Changed!

Matter has properties, we can do things to change properties, and these changes are reversible or irreversible.

3rd Grade Example:
Objects move in different ways on the playground

A force is a push or pull, it has strength and direction, it can be balanced and unbalanced, and it acts between objects that do and do not touch

Approximating the work of scientists and engineers

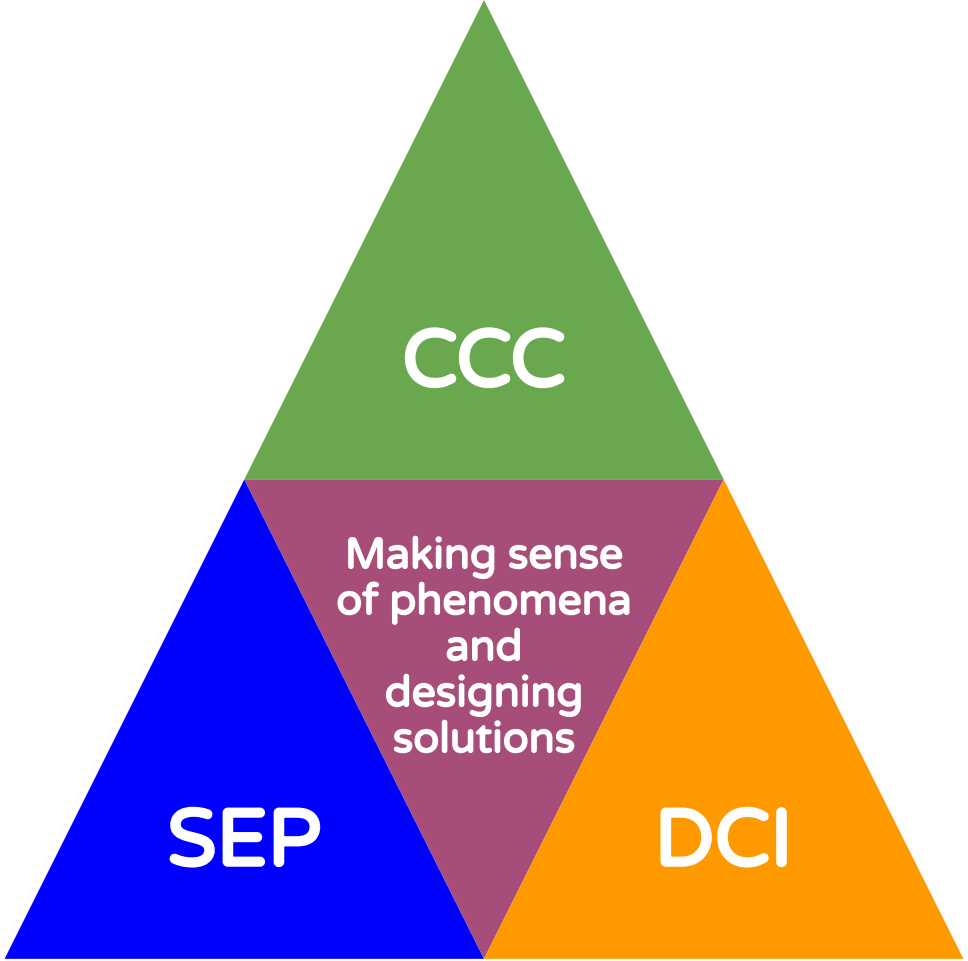
✨Sparking✨ science curiosity

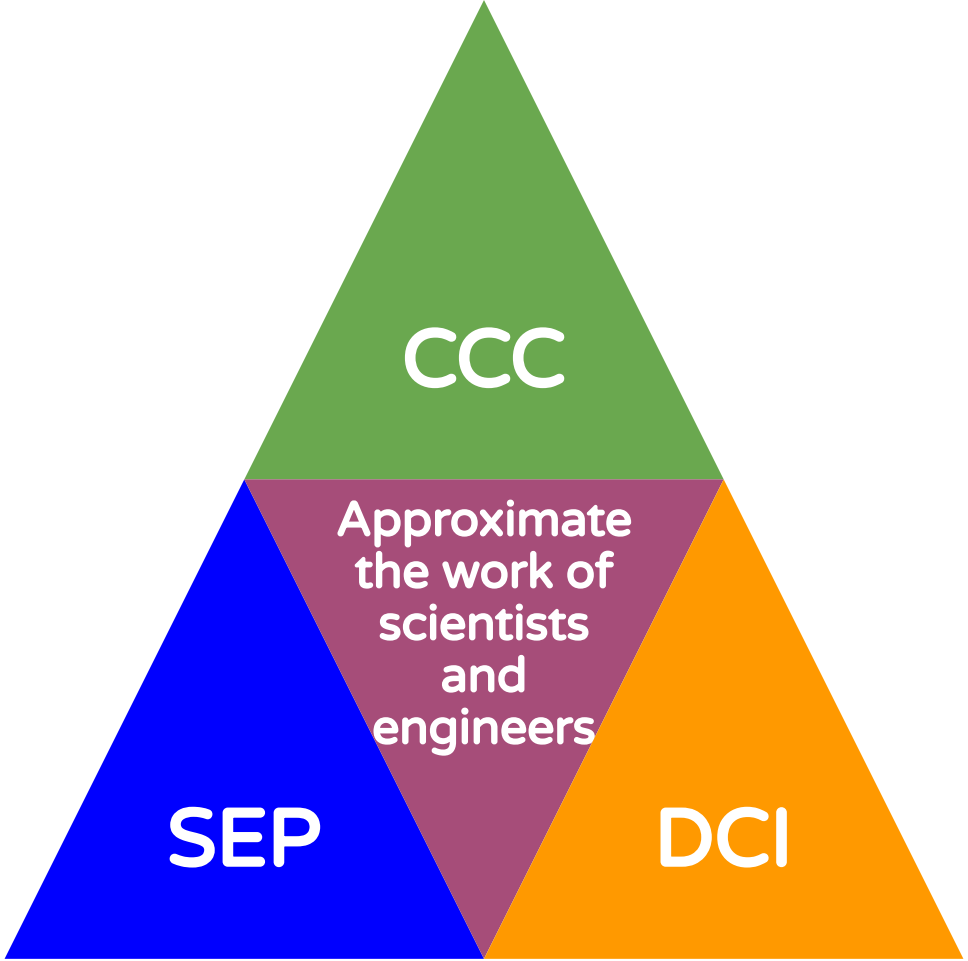
Making sense of phenomena and designing solutions to problems

Scientists and engineers engage in practices to do their work

Scientists and engineers work with ideas that cut across disciplines

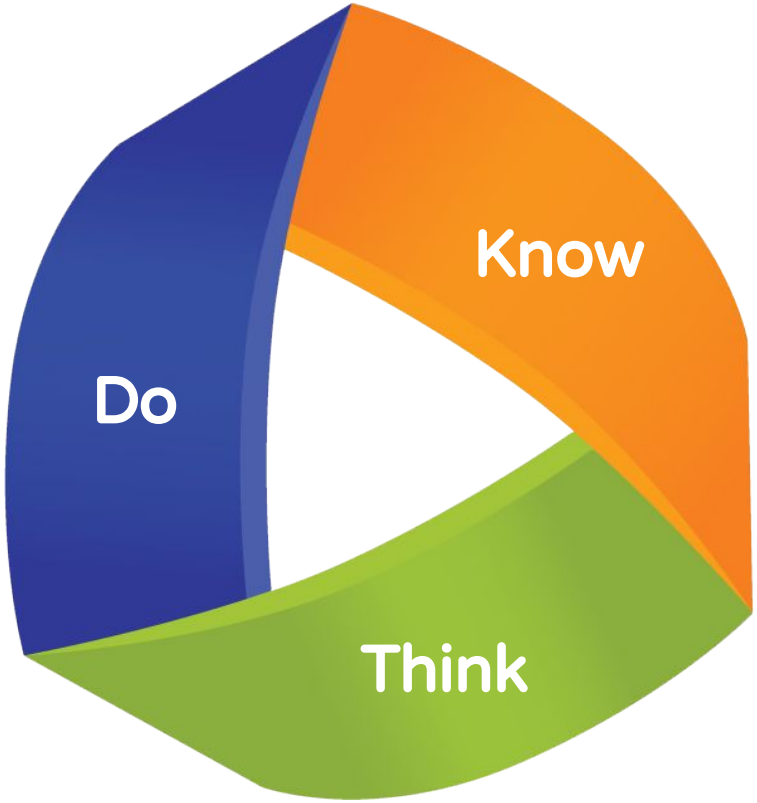
Scientists and engineers generate knowledge and solve problems


CCC
Making sense of phenomena and designing solutions
SEP
DCI


CCC
Approximate the work of scientists and engineers
SEP
DCI

Three-Dimensional learning

SEP
Science and Engineering Practices



DCI
Disciplinary Core Ideas

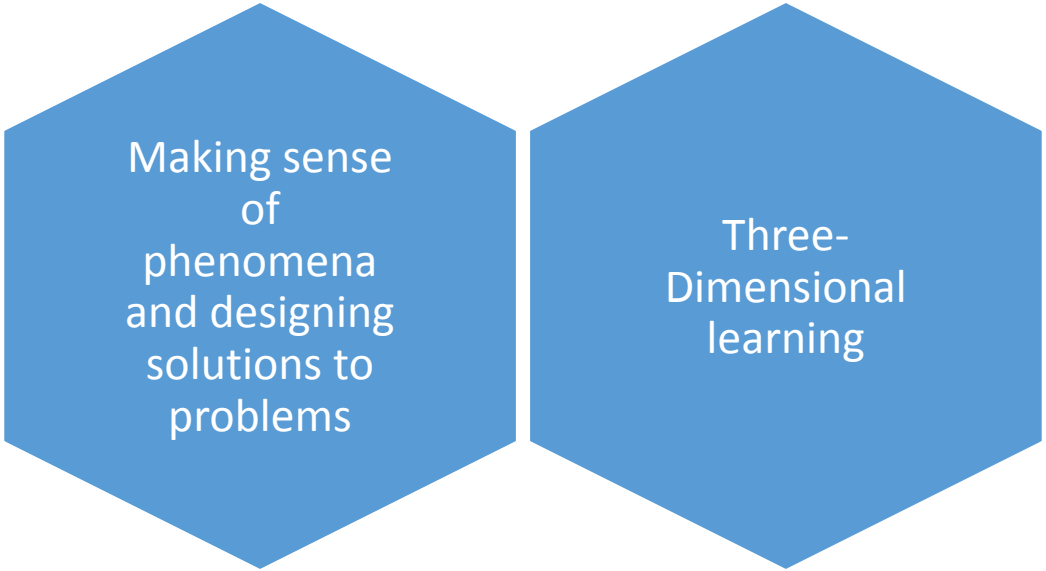
CCC
Crosscutting Concepts

Reflect on:

What would you see or hear in a classroom if students are

experiencing three dimensional learning

that is centered on them explaining phenomenon and solving problems?


Making sense of phenomena and designing solutions to problems
Three-Dimensional learning

Agenda

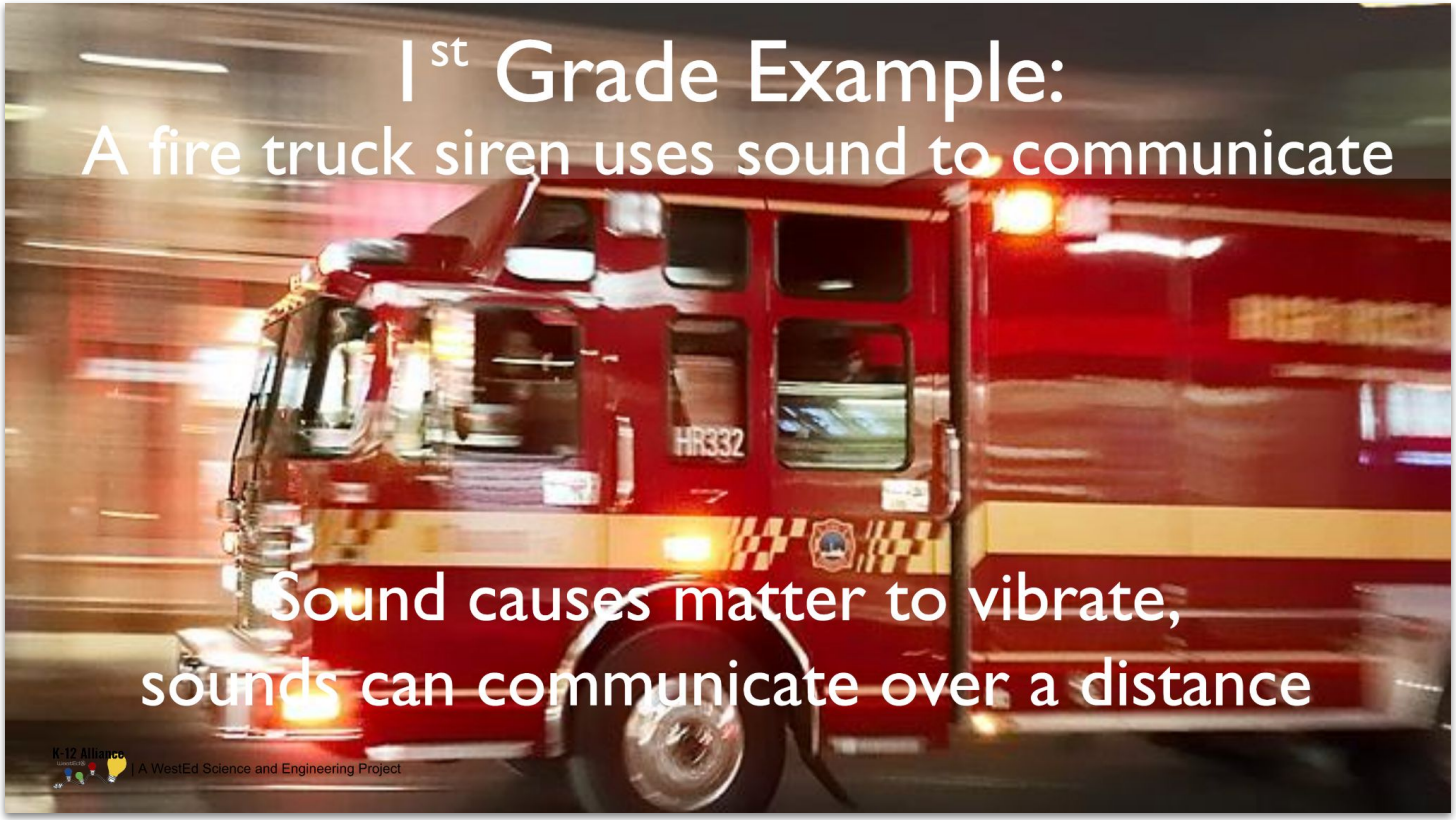
How are the Next Generation Science Standards (NGSS) changing classrooms?

Introductions and overview

Shifts at the heart of the science standards

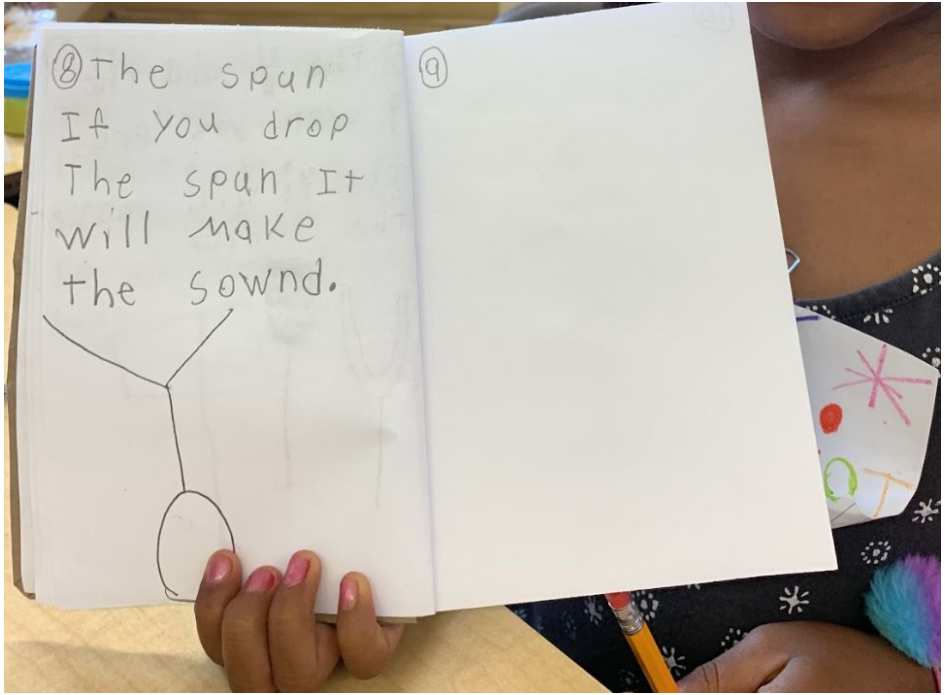
Practices that support student sensemaking in science

What does this type of learning look like?


1st Grade Example:
A fire truck siren uses sound to communicate
HR332
Sound causes matter to vibrate,
sounds can communicate over a distance
K-12 Alliance | A WestEd Science and Engineering Project

Students are given opportunities to

Plan and conduct investigations and construct an explanation demonstrating that vibrating matter can cause sound.



Sharing our models explaining how our instrument made sound

“We finished the next three instruments and shared in a group. The kids were saying,

- *It feels bumpy when you touch it*
- *I can hear the bumpy*
- *I can feel the bumpy*

I asked questions to get them to the vocabulary word **vibration**”

Teacher A'Ha's!

"**Students can** articulate and process through exploring"

"Learn to just process of just asking the question. They give me the answer I'm so excited and want to stop it there - but then I ask them to say more and repeat what someone said and **be ok with that time**. We are usually so pressured for time."

"They aren't, *"this isn't working, I give up"*, not one of them said that. **They are willing to learn through struggle**

"Students come in knowing more than we think they do. We thought less of kids, and in our interactions with them, we realize **they have more than we thought they did**"

SEP
Science and Engineering Practices

Agenda

How are the Next Generation Science Standards (NGSS) changing classrooms?

Introductions and overview

Shifts at the heart of the science standards

Practices that support student sensemaking in science

What does this type of learning look like?

California OpenSciEd Elementary Field Test

Supporting Sensemaking in Discussions

Building Understandings Discussion (L)

Purpose/Goals in the Storyline

- Share, connect, critique, and build on others' findings, claims, evidence, and explanations from an investigation.
- Arrive at tentative conclusions: We have a new piece of evidence... what does that mean for us?
- An opportunity for teachers to formatively assess lesson-level collective sensemaking (though not all students may agree and our model or explanation is not yet complete)

Teacher Role	Student Role
- Set and maintain focus around the specific lesson question - Invite students to share claims, explanations, solutions with a focus on elaboration of evidence and reasoning - Encourage alternative explanations using evidence - Help the group come to tentative conclusions and next steps to investigate the anchor phenomenon	- Attempt to explain a lesson-level question - Use data from lesson investigation as evidence to support their claims or partial explanations - Compare, contrast and ask questions about each others' claims, evidence, explanations

From the OpenSciEd Elementary Teacher Handbook
(Field test version, December 2023)

Reflect on:

Reflect on what the Next Generation Science Standards call for in classrooms today:

How is this similar or different to your own experiences?

What is a take-away you have that could inspire your classroom practice or how you support children and/or teachers?

LESS OF	MORE OF
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

Curiosity

sensemaking

Post in the chat:

Got

What is something you "got" today?

An understanding, an "aha", or even a challenge

Need

What is something you still need that might help your understanding?

Jill Grace
jgrace@wested.org

Andrea Frías
afrias@wested.org

Thank you!

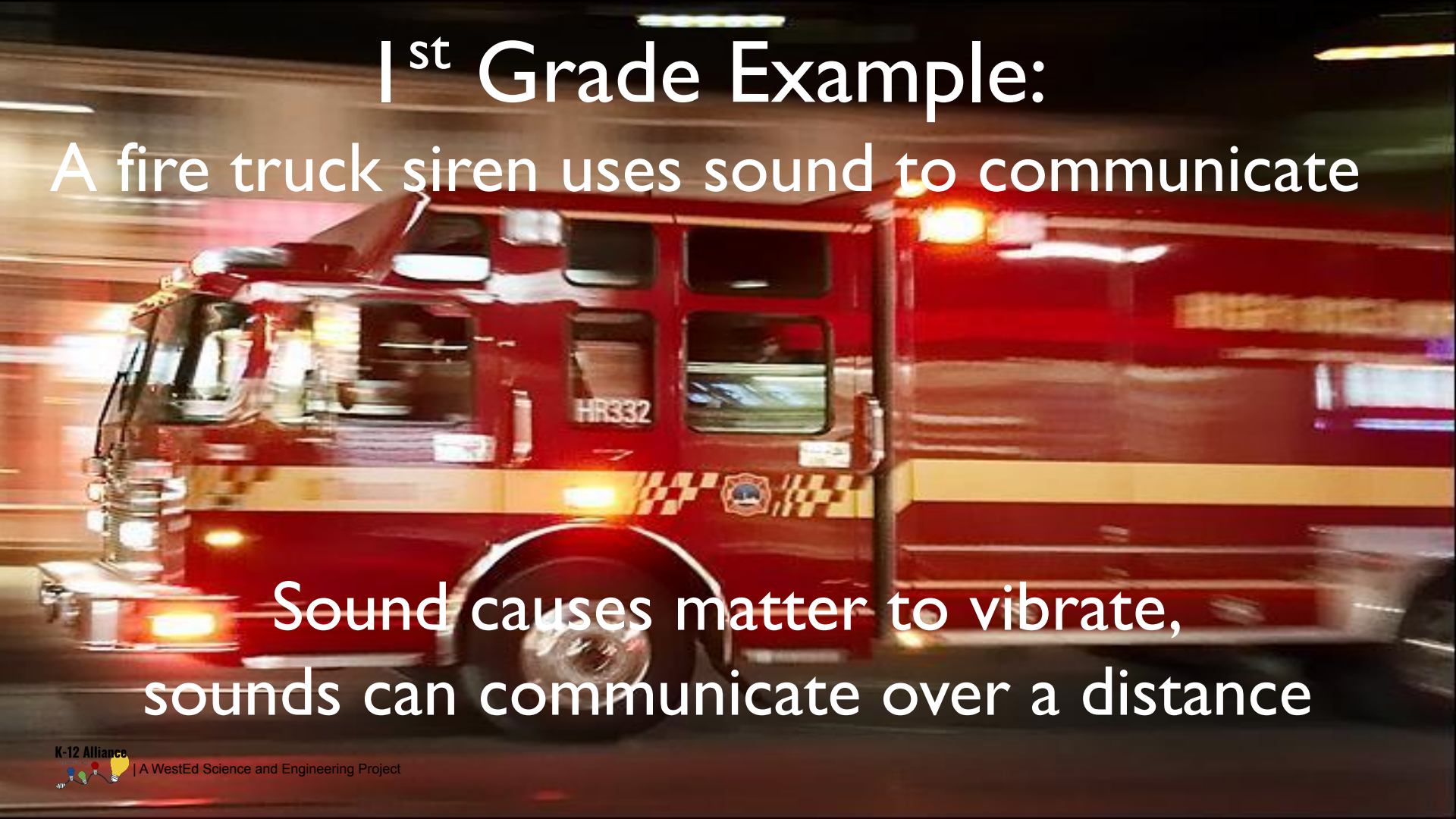
K-12 Alliance
WestEd

Kindergarten Example:
Objects Do Not Move On Their Own

Movement is caused by pushes and pulls and can happen in different directions

1st Grade Example:

A fire truck siren uses sound to communicate



Sound causes matter to vibrate,
sounds can communicate over a distance

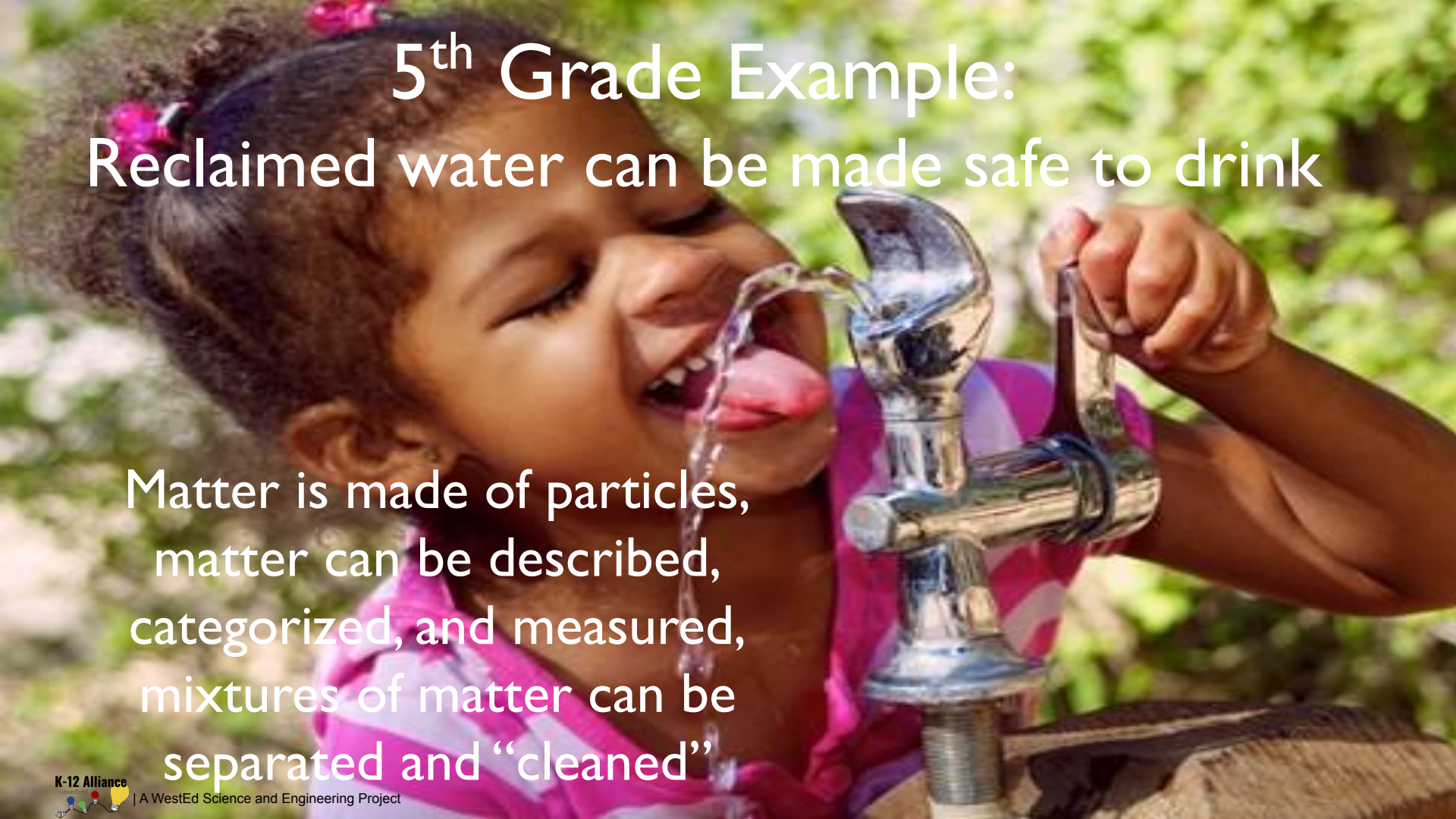
2nd Grade Example:
The Crayons Changed!

Matter has properties, we can do things to change properties, and these changes are reversible or irreversible.

3rd Grade Example:

Objects move in different ways on the playground

A force is a push or pull, it has strength and direction, it can be balanced and unbalanced, and it acts between objects that do and do not touch



5th Grade Example:
Reclaimed water can be made safe to drink

Matter is made of particles, matter can be described, categorized, and measured, mixtures of matter can be separated and "cleaned"

Science practices compliment math practices?

Features of Classroom Culture that Support Equitable Sensemaking

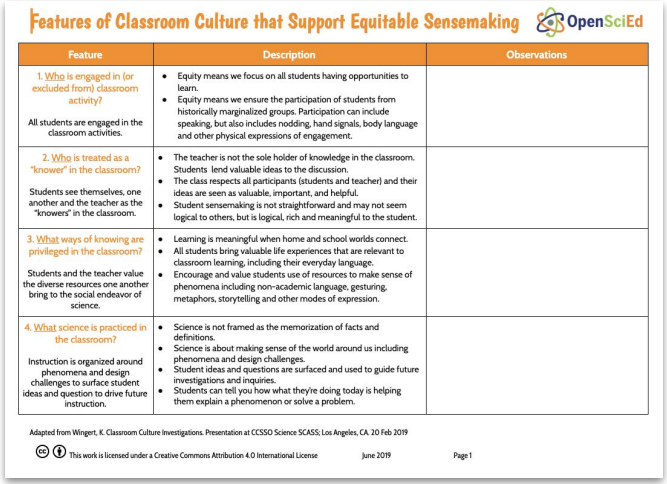
All Standards All Students = equitable access to science education

1 Who is engaged in classroom activity?

2 Who is treated as a "knower"?

3 What ways of knowing are privileged?

4 What science is practiced?



Features of Classroom Culture that Support Equitable Sensemaking — OpenSciEd

Feature	Description	Observations
1. Who is engaged in (or excluded from) classroom activity? All students are engaged in the classroom activities.	• Equity means we focus on all students having opportunities to learn. • Equity means we ensure the participation of students from historically marginalized groups. Participation can include speaking, but also includes nodding, hand signals, body language and other physical expressions of engagement.	
2. Who is treated as a "knower" in the classroom? Students see themselves, one another and the teacher as the "knowers" in the classroom.	• The teacher is not the sole holder of knowledge in the classroom. Students lend valuable ideas to the discussion. • The class respects all participants (students and teacher) and their ideas are seen as valuable, important, and helpful. • Student sensemaking is not straightforward and may not seem logical to others, but is logical, rich and meaningful to the student.	
3. What ways of knowing are privileged in the classroom? Students and the teacher value the diverse resources one another bring to the social endeavor of science.	• Learning is meaningful when home and school worlds connect. • All students bring valuable life experiences that are relevant to classroom learning, including their everyday language. • Encourage and value students use of resources to make sense of phenomena including non-academic language, gesturing, metaphors, storytelling and other modes of expression.	
4. What science is practiced in the classroom? Instruction is organized around phenomena and design challenges to surface student ideas and question to drive future instruction.	• Science is not framed as the memorization of facts and definitions. • Science is about making sense of the world around us including phenomena and design challenges. • Student ideas and questions are surfaced and used to guide future investigations and inquiries. • Students can tell you how what they're doing today is helping them explain a phenomenon or solve a problem.	

Adapted from Wingert, K. Classroom Culture Investigations. Presentation at CCSSO Science SCASS; Los Angeles, CA. 20 Feb 2019

This work is licensed under a Creative Commons Attribution 4.0 International License

Adapted from work by
Kerri Wingert, University of Colorado Boulder

All Standards All Students = equitable access to science education

Science and engineering education can be conceptualized not just as a component of a school curriculum, but as a ***critical human and civil right for children****.*

The National Academies Press, 2022

Reflect on:

Your understanding of the
Next Generation Science Standards (NGSS).

Share in the chat:

- What are some things you know?
- What are some questions you have?