Introduction to the Science Standards for Alaska Grades 3-5

1

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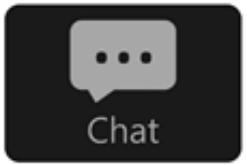
Zoom Tips

Everyone in the meeting is muted. Please remain muted unless you are in a breakout session or asked to share out.

Presenters love seeing their audience, so if you're comfortable, turn your camera on so they can see you nodding in understanding and encouragement. If you want to make sure to look your best, face a window or light source.



The chat box is a good place to engage with other participants and ask questions. Selecting this icon will open the chat window.

Speaker/Gallery View

Speaker view shows the active speaker. Gallery shows all participants. Make sure to take the time to find that button (at the top right corner of your screen) so you can switch between the views.

Zoom Norms

- Be Present
- Be Curious
- Be Open to Sharing

Rename:
Name, Grade Level, Where you teach

Objectives

- Introduction to the Science Standards of Alaska (SSAs)
- Differences between the GLE's and the SSAs
- 3-Dimensional Teaching
- Transforming existing lessons to SSA supported lessons ~ integrating
- Resources for teaching the Science Standards of Alaska

Breakout Discussions

- Your name
- Names of the river on which your district is located,
  and the ancestral people of that land
- If you had to eat one meal for the rest of your life, what would it be?

When last standards were implemented:

- "dot" as in dot-com was most useful word of year
- VHS tapes had to be rewound before returning
- $2,000 camera could store 20 minutes of video or 3000 pictures with 0.3 megapixels of info
- $400 MPMAN could store 6 of your favorite songs
- Human Genome yet to be mapped

Thinking…

- 70% of jobs in 2020 were in STEM fields
- Is 70% of our curriculum STEM?

A Starting Point ~ 2009

- "The Opportunity Equation"
  Published by Carnegie Foundation and Institute for Advanced Studies
- "Must dramatically change the way we teach science to our students"
- "Failing to provide a science education for our students will be the equivalent of a permanent economic recession."

And then…

- Carnegie Foundation funded the Framework for K-12 Science Education
- National Resource Council wrote the Framework for K-12 Science – National Academies Press
- Next Generation Science Standards (2013) are based on Framework for K-12 Science Education
- Science Standards for Alaska (2019) are based on Framework for K-12 Science Education

Waterfall...

- A question is asked.
- Group has 2-3 minutes to answer the question.
- Great strategy for think-time in online learning.

A Day in the Life…

Think of any of the best days you ever experienced teaching science…

Or, think about what it would look like if you walked into a classroom and the students were involved in an amazing science experience…

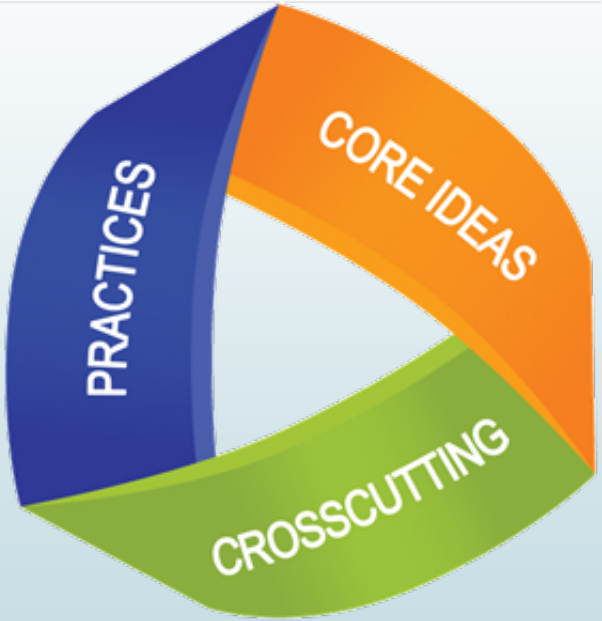
What do those experiences look like?

Goal of the Framework

"To ensure that by the end of 12th grade all students :

- ❑ appreciate the beauty and wonder of science;
- ❑ have sufficient knowledge of science and engineering to engage in community discussions;
- ❑ are careful consumers of scientific and technological information;
- ❑ have skills to enter careers of their choice, including (not limited to) the STEM fields."

3-Dimensional Learning



What happened to Inquiry?

Students use the

Science and Engineering Practices

to make sense of phenomena

in the world around them

Crosscutting

to deepen

Science and Engineering Practices

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Waterfall-Science Practices

What are ways you have used these practices in teaching science, or what ideas do you have for how you might use them in the future?

Science and Engineering Practices

- Asking questions and defining problems.
- Developing and using models
- Planning and carrying out investigations.
- Analyzing and interpreting data.
- Using mathematics and computational thinking.
- Constructing explanations and designing solutions.
- Engaging in argument from evidence.
- Obtaining, evaluating, and communicating information.

Crosscutting Concepts

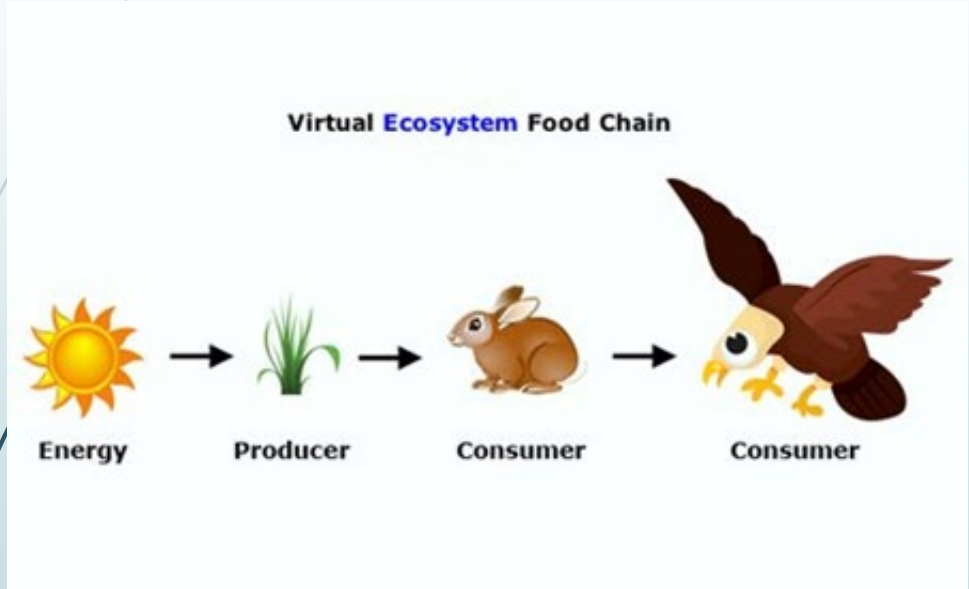
- Patterns
- Cause and Effect
- Scale Proportion and Quantity
- Systems and System Models
- Energy and Matter
- Structure and Function
- Stability and Change

Using Cross Cutting Concepts

Questions can use the crosscutting concepts to focus students' thinking on making sense of phenomena.

- What patterns do you see that can be used as evidence?
- How does the system change when more energy is added to the system?

Waterfall-energy and matter



Think of a question that asks students to explain how energy and matter flow through a food chain.

Disciplinary Core Ideas

Life Science	Physical Science
LS1: From Molecules to Organisms: Structures and Processes	PS1: Matter and Its Interactions
LS2: Ecosystems: Interactions, Energy, and Dynamics	PS2: Motion and Stability: Forces and Interactions
LS3: Heredity: Inheritance and Variation of Traits	PS3: Energy
LS4: Biological Evolution: Unity and Diversity	PS4: Waves and Their Applications in Technologies for Information Transfer
Earth & Space Science	**Engineering & Technology**
ESS1: Earth's Place in the Universe	ETS1: Engineering Design
ESS2: Earth's Systems	ETS2: Links Among Engineering, Technology, Science, and Society
ESS3: Earth and Human Activity	

So what is different?

A shift from students:

"learning about"

to

students "figuring out about"…

If someone comes up to a group of students and asks, "What are you working on?"

"We're trying to figure out…"

Shifts in Science Education

A deep understanding of science is important for all students.

Moving on From Memorization

Less:

- Rote memorization of facts, principles, scientific laws, and terminology.

More:

- Facts and terminology are learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning.

Student-Centered Education

Less:

- Teachers providing information to the whole class.

More:

- Students conducting collaborative investigations, solving problems, and engaging in discussions with teacher guidance.

Based on Investigations

Less:

- Pre-planned outcome for "cookbook" laboratories and hands-on activities.

More:

- Multiple investigations driven by students' questions with a range of possible outcomes that collectively lead to a deep understanding of established core scientific ideas.

2-PS1-2

Students who demonstrate understanding can: Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*

Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.

Assessment Boundary: Assessment of quantitative measurements is limited to length.

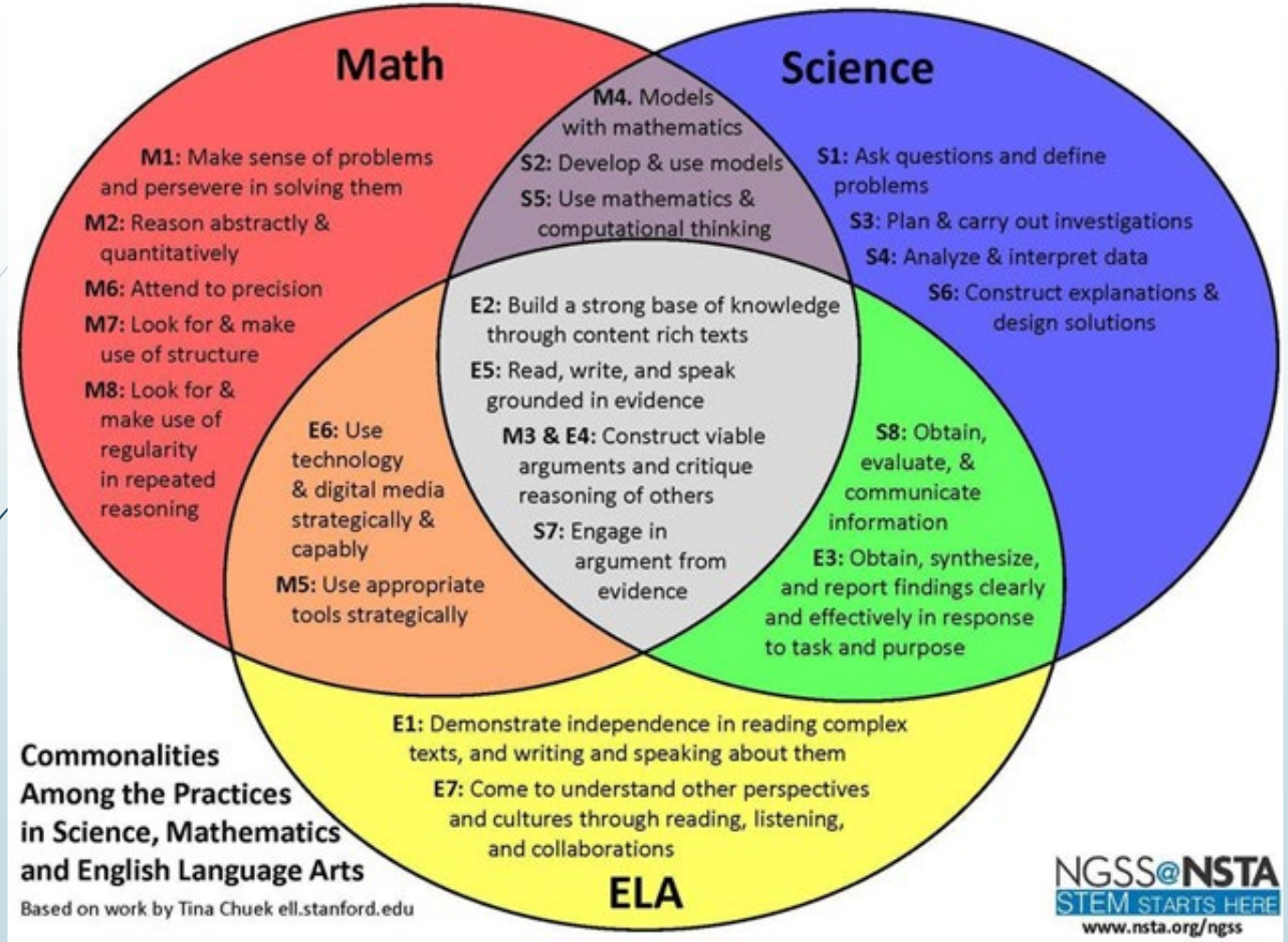
The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data • Analyze data from tests of an object or tool to determine if it works as intended.	**PS1.A: Structure and Properties of Matter** • Different properties are suited to different purposes.	**Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes. **Connections to Engineering, Technology, and Applications of Science** **Influence of Engineering, Technology, and Science, on Society and the Natural World** • Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.

As in this example, the performance expectations marked with an asterisk* integrate traditional science content with engineering through a practice or disciplinary core idea. (https://www.nextgenscience.org)

Integrating Math and Language Arts into Science

- language acquisition and practice,
- application of math skills
- students are engaged in exploring local phenomena


Math
Science
ELA
M1: Make sense of problems and persevere in solving them
M2: Reason abstractly & quantitatively
M6: Attend to precision
M7: Look for & make use of structure
M8: Look for & make use of regularity in repeated reasoning
M4. Models with mathematics
S2: Develop & use models
S5: Use mathematics & computational thinking
S1: Ask questions and define problems
S3: Plan & carry out investigations
S4: Analyze & interpret data
S6: Construct explanations & design solutions
E2: Build a strong base of knowledge through content rich texts
E5: Read, write, and speak grounded in evidence
M3 & E4: Construct viable arguments and critique reasoning of others
S7: Engage in argument from evidence
E6: Use technology & digital media strategically & capably
M5: Use appropriate tools strategically
S8: Obtain, evaluate, & communicate information
E3: Obtain, synthesize, and report findings clearly and effectively in response to task and purpose
E1: Demonstrate independence in reading complex texts, and writing and speaking about them
E7: Come to understand other perspectives and cultures through reading, listening, and collaborations
Commonalities Among the Practices in Science, Mathematics and English Language Arts
Based on work by Tina Chuek ell.stanford.edu
NGSS@NSTA
STEM STARTS HERE
www.nsta.org/ngss

Math	Science	English Language Arts
M1. Make sense of problems and persevere in solving them.	**S1.** Asking questions (for science) and defining problems (for engineering).	**E1.** They demonstrate independence.
M2. Reason abstractly and quantitatively.	**S2.** Developing and using models.	**E2.** They build strong content knowledge.
M3. Construct viable arguments and critique the reasoning of others.	**S3.** Planning and carrying out investigations.	**E3.** They respond to the varying demands of audience, task, purpose, and discipline.
M4. Model with mathematics.	**S4.** Analyzing and interpreting data.	**E4.** They comprehend as well as critique.
M5. Use appropriate tools strategically.	**S5.** Using mathematics, information and computer technology, and computational thinking.	**E5.** They value evidence.
M6. Attend to precision.	**S6.** Constructing explanations (for science) and designing solutions (for engineering).	**E6.** They use technology and digital media strategically and capably.
M7. Look for and make use of structure.	**S7.** Engaging in argument from evidence.	**E7.** They come to understanding other perspectives and cultures
M8. Look for and express regularity in repeated reasoning.	**S8.** Obtaining, evaluating, and communicating information.	

Three-Dimensional Teaching

Chapters of the Book

- The Chapters of the Book are the **Core Ideas**
- The **Crosscutting Concepts** are the themes
- The **Science and Engineering Practices** are the strategies you utilize to read the book

Instead of…

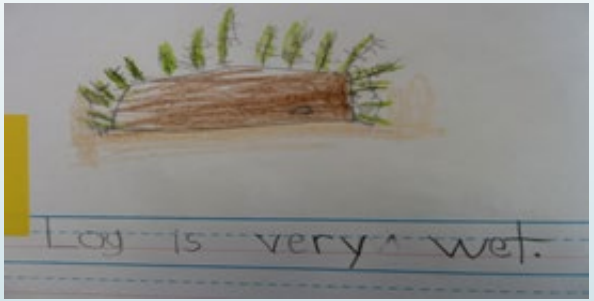
"Students will understand that…"

TRY

"Students who demonstrate understanding…"

Adapting Lessons to Science Standards of Alaska

- Phenomena
- Connections to local community and culture
- Storylines
- Students engaged in figuring out the phenomena



Connections to Community and Culture

In your area, what are some community and cultural influences?

- Oil and gas?
- Fishing?
- Mining?
- Subsistence?
- Native Alaskan culture/traditions?
- Sports?

Storylines

- Sequence of lessons
- Driven by student questions
- Goal is to explain phenomenon
- Each piece adds to their explanation
- Each piece creates new questions
- Builds core ideas and cross cutting concepts
- https://www.nextgenstorylines.org/what-are-storylines

How does this all come together?

- Let's Talk About The Weather!
- ***Chat ~ If you were a weather report, what would your forecast be?***
- Use your Alaska filter!
- The Standards
- The Phenomenon ~ Weather study
- The Search ~
  Finding lessons related to phenomena
  Vetting the lessons… Are they 3 Dimensional?
- The Fun Part ~ guiding learning
- The Assessment ~ check for understanding


Mom, looks like Johnny couldn't hold it again.
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The Standards

3. Weather and Climate

Students who demonstrate understanding can:

3-ESS2-1

Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. [Clarification Statement: Examples of data at this grade level could include student-generated graphs of average temperature, precipitation, and wind direction.] [*Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.*]

3-ESS2-2

Obtain and combine information to describe climates in different regions of the world.

3-ESS3-1

Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.* [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent storm erosion or flooding (e.g., from storm surges), or buildup of snow drifts; wind resistant roofs, lightning rods, and other weather hazards such as white-out conditions.]

Find at AK DEED SSA website

Where do I find 3-D lessons?

Project Learning Tree

Google! :)

Project WILD

District Curriculum Resources

Alaska Fish and Game

Project WET

NGSS@NSTA

nextgenscience.org

Weather Unit/Lesson 4 Humidity

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Weather & Climate
Lesson #4: Water in the Air: Humidity and Precipitation

Essential Question: How does weather and climate affect our lives?

Standards:

3-ESS-6 Explain how air temperature, moisture, wind speed and direction, and precipitation make up the weather in a particular place and time.

Objectives:

1. Explain how humidity influences weather and how humidity readings can be used to make weather forecasts (predictions).
2. Make predictions about levels of humidity, conduct experiments, and analyze the results.

Assessment: Science notebook responses, participation in class activities and discussions, completion of the humidity experiments, bar graph worksheet (to be completed by the classroom teacher)

Vocabulary:

Humidity: a quantity representing the amount of water vapor in the atmosphere or a gas

Once students have a conceptual understanding of the vocabulary word they should create a 4-Square (Frayer Method from Key Vocabulary Routine) for the above word(s).

Phenomena

- https://www.youtube.com/watch?v=Dnk0Be4a0aw

Phenomena/Problems Should…

- Be local! …community, region, state, national, global… …conditions, issues, current events…
- Be something students can observe, model, predict, compare, analyze, measure
- Be connected to a Performance Expectation
- Anchor and drive 3-Dimensional Learning throughout the study, the focus
- Phenomena LEAN toward Science/ Problems LEAN towards Engineering

The Fun Part

It's time to teach!

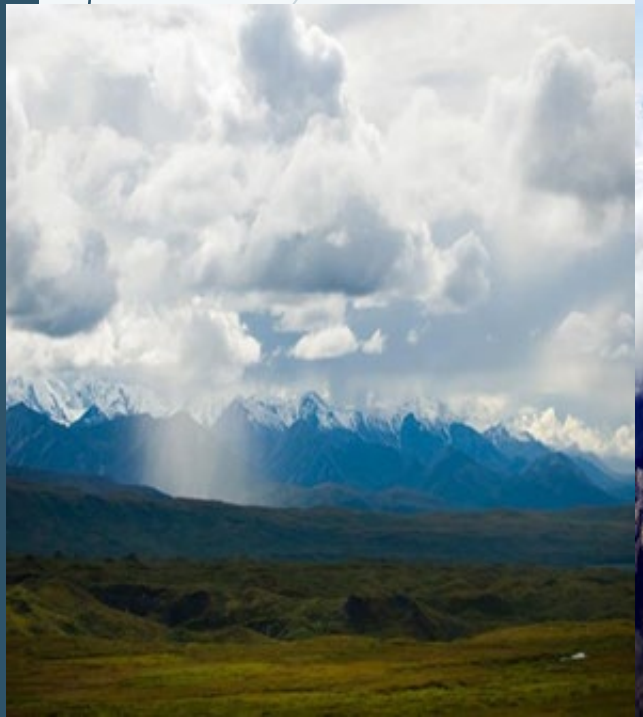
Lesson 4 Humidity and Precipitation

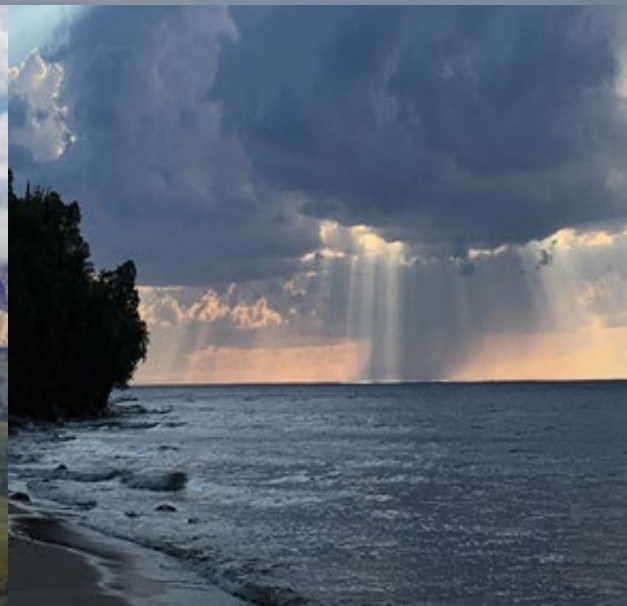
Phenomenon come in all forms

Cloud in a bottle 2

Teachable moments!

Photos from the internet





Or a problem?

Videos

...at school!

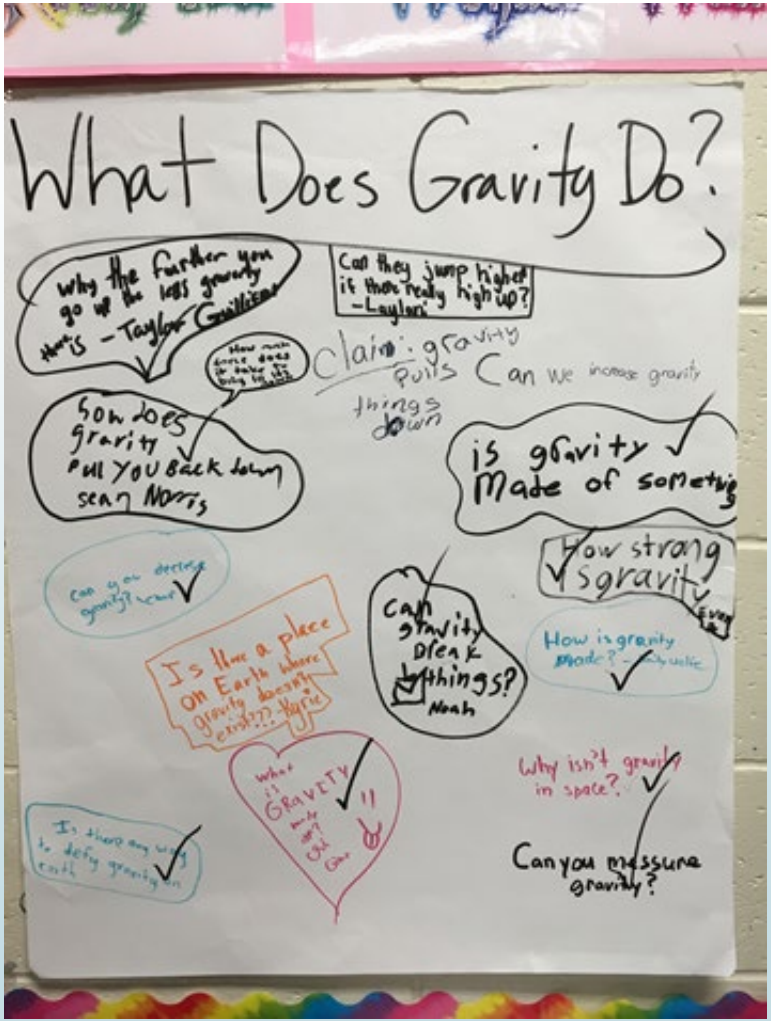
Tornado-
What questions could we come up with using this phenomenon?

Or IS IT a Problem?

Now It's Your Turn--Can You Find a Phenomena?

- All around you!
- Take pictures!
- **Activity:**
  3 minutes ~ Take a walk through your environment looking for Phenomena. Take a picture and bring it back to the meeting.
- 1, 2, 3 ~ Hold your phone up to the camera on your device and enjoy the Phenomena!

Wonderwall - write your phenomena questions throughout the study



Weather Unit-Lesson 4 Humidity

Weather & Climate
Lesson #4: Water in the Air: Humidity and Precipitation

Essential Question: How does weather and climate affect our lives?

Standards:

3-ESS-6 Explain how air temperature, moisture, wind speed and direction, and precipitation make up the weather in a particular place and time.

Objectives:
1. Explain how humidity influences weather and how humidity readings can be used to make weather forecasts (predictions).
2. Make predictions about levels of humidity, conduct experiments, and analyze the results.

Assessment: Science notebook responses, participation in class activities and discussions, completion of the humidity experiments, bar graph worksheet (to be completed by the classroom teacher)

Vocabulary:
Humidity: a quantity representing the amount of water vapor in the atmosphere or a gas
Once students have a conceptual understanding of the vocabulary word they should create a 4-Square (Frayer Method from Key Vocabulary Routine) for the above word(s).

Sample Assessment
Weather

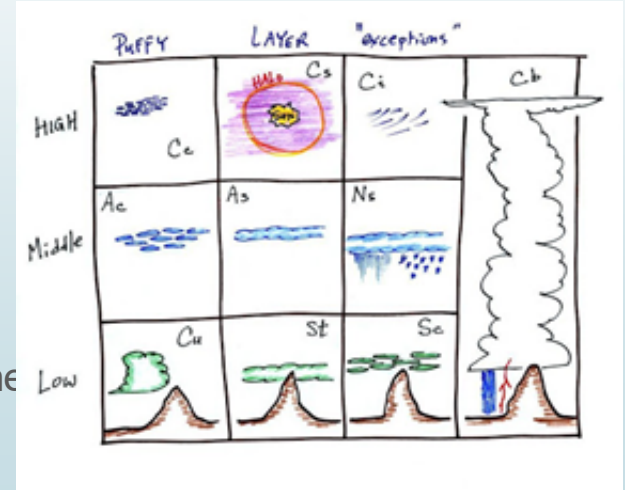
Elicits **sense-making and problem solving** by focusing on reasoning through scientific and engineering **evidence**, models, and principles

Observational (task work)

Culminating project (make a graph or model)

Science Notebook (check for understandings and misunderstandings)

Driven by meaningful and engaging scenarios (phe based)



Designed to elicit 3 Dimensional responses (i.e., must use multiple dimensions together)

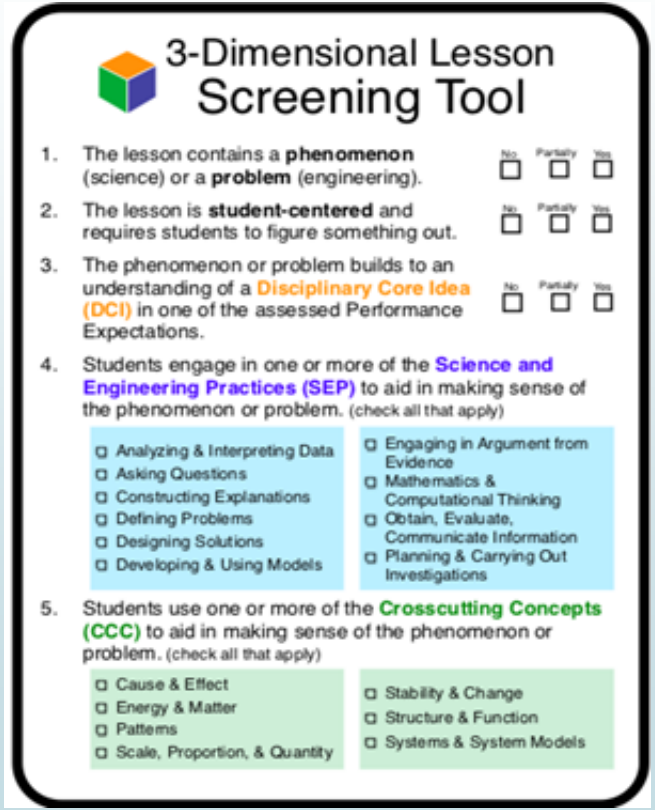
How do I transform existing Science Lessons? Your turn!

Break out in groups-10 min

In your groups think about ways that you can change your lessons to make them more 3 dimensional?

Also, discuss ways to integrate Math and Language Arts into your lessons.

Analyzing 3D Lessons



3-Dimensional Lesson Screening Tool

1. The lesson contains a **phenomenon** (science) or a **problem** (engineering). ☐ No ☐ Partially ☐ Yes
2. The lesson is **student-centered** and requires students to figure something out. ☐ No ☐ Partially ☐ Yes
3. The phenomenon or problem builds to an understanding of a **Disciplinary Core Idea (DCI)** in one of the assessed Performance Expectations. ☐ No ☐ Partially ☐ Yes
4. Students engage in one or more of the **Science and Engineering Practices (SEP)** to aid in making sense of the phenomenon or problem. (check all that apply)
   - ☐ Analyzing & Interpreting Data
   - ☐ Asking Questions
   - ☐ Constructing Explanations
   - ☐ Defining Problems
   - ☐ Designing Solutions
   - ☐ Developing & Using Models
   - ☐ Engaging in Argument from Evidence
   - ☐ Mathematics & Computational Thinking
   - ☐ Obtain, Evaluate, Communicate Information
   - ☐ Planning & Carrying Out Investigations
5. Students use one or more of the **Crosscutting Concepts (CCC)** to aid in making sense of the phenomenon or problem. (check all that apply)
   - ☐ Cause & Effect
   - ☐ Energy & Matter
   - ☐ Patterns
   - ☐ Scale, Proportion, & Quantity
   - ☐ Stability & Change
   - ☐ Structure & Function
   - ☐ Systems & System Models

The Vision for Science K-12

Students engaging in the

three dimensions

of learning science

is foundational for achieving

the vision of the Science Standards for Alaska.

Ask yourself…

How does, what the students are doing incorporate the Science Standards for Alaska?

“We’re trying to figure out…”

What is actionable now?

- Within your classroom?
- Within your school?
- Within your curriculum?
- Within your district/community?

Resources

- DEED Standards | https://education.alaska.gov/standards/science
  - SSA Introduction webinar; Webinars: Grades K-2, Grades 3-5, Grades 6-8; Grades 9-12;
  - Student Preparation for PEAKS
- National Science Education Leadership Association | www.NSELA.org
- Bozeman Science | www.bozemanscience.com
- Alaska Science Teachers Association | http://asta.wildapricot.org
- Download the "Framework for Science K-12" free | www.nap.gov
- Next Generation Science Standards | www.nextgenscience.org

Resources

- Chief Council of State School Officers | White paper on Using the Crosscutting Concepts
- Andrea's Alaska Teacher's Blog | http://learnscape.org/blog
- National Science Teachers Association | www.ngss.nsta.org
- https://www.nextgenstorylines.org/what-are-storylines
- Phenomenon | www.ngssphenomena.com/about
- ADFG
- AquaticWILD | https://www.fishwildlife.org/projectwild/aquatic-wild
- Alaska Zoo | www.alaskazoo.org

What else would you like to know about the Science Standards for Alaska?

Thank you

Jason Daniels; Kenai Borough School District
JDaniels@kpbsd.k12.ak.us

Trisha Herminghaus; Alaska Science Education Consultants;
therminghaus@gmail.com

End of Webinar

Need a Lesson?

Use this playground weather phenomenon to create a 3 dimensional lesson!

Science and engineering practices-actions

Disciplinary core ideas-what is weather?

Cross cutting concepts-patterns, stability/change

Using Crosscutting Concepts

Check out the SSA Introduction Webinar on the DEED site

Take time to go to the Resources page and explore the possibilities!

As you move through your day, take note of potential phenomena in the world around you!

Consider joining the Alaska Science Teachers Association (ASTA)

Join ASTA and your colleagues from around the state for the STEAM Conference in Juneau, October 21-23, 2021!

Join the National Science Teaching Association for access to tremendous resources and opportunities.

Attend the Annual Conference on Science Education! (NSTA.org)

Participant Resources Handout-Google Doc?

Ngss.nsta.org-vetted science lessons
Nextgenscience.org-searchable Science Standards website
Has evidence statements!
https://www.teachtci.com/-curriculum with online and offline formats. Aligned with NGSS and inquiry-based

NextGenScience.org

- Sort standards by Grade Level and topic
- Standards can be mixed and matched from different content areas ~ "bundling"

Example: Erosion
~ Earth and Space Science
  * weathering,
~ Physical Science
  • energy transfer
~ Life Science
  • ecosystems

What do we do now?

- Use Framework for K-12 Science: Practices, Crosscutting Concepts, and Core Ideas
- Consider including Practices and Crosscutting Concepts in this year's science units

A core idea for K-12 science instruction is a scientific idea that:

- Has broad importance across multiple science or engineering disciplines, or is a key organizing concept of a single discipline.
- Provides a key tool for understanding or investigating more complex ideas and solving problems.
- Relates to the interests and life experiences of students or can be connected to societal or personal concerns that require scientific o technical knowledge.

Definitions of Technology, Engineering, and Applications of Science

- *Technology* is any modification of the natural world made to fulfill human needs or desires.
- *Engineering* is a systematic and often iterative approach to designing objects, processes, and systems to meet human needs and wants.
- *An Application of Science* is any use of scientific knowledge for a specific purpose, whether to do more science; to design a product, process, or medical treatment; to develop a new technology; or to predict the impacts of human actions.

What is the timeline for implementation?

- **Early 2013** ~ Release of NGSS
- **2013 - 2014** ~ 26? Lead states adopt
- **2014 -?** ~ States consider adoption
- **2014 -?** ~ Implementation activities
- **2015?** ~ Assessment development

Why Practices

- The Framework considers the practices to be central to science a engineering
- Practices:
  - Engage students productively in inquiry
  - Inquiry is an element in the practices
  - Support the learning process
  - Help students understand aspects of the science and engineering enterprise

NGSS in Units

- Select topic
- Select ILF Overarching Understandings/PE's
- Select AK GLE's
- Look at Framework Grade Band Endpoints for conceptual focus on topic to guide unit development

Dear Optimist, Pessimist, and Realist,

While you were talking about the glass of water, I drank it.

Sincerely,
The Opportunist

Why New Science Standards?

- Existing standards > 15 years old
- Reduction of the United States' competitive economic edge
- Lagging achievement of U.S. students… Mile wide…
- Essential preparation for all careers in the modern workforce ~ 70% of jobs in 2020 will be in STEM fields
- Scientific and technological literacy for an educated society

Instructions

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- Please use this template for your webinar presentation.
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- Feel free to use the "Design Ideas" feature in PowerPoint to spice up your slides if your version supports it. This can be found on the "Design" menu at the far right of the ribbon bar.
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- Please make use of the "Notes" section where possible to include important narrative and ideas that are not

Bibliography

Pinterest

Atmospheric science

Google images

unearthedcomics.com

https://www.nextgenstorylines.org/what-are-storylines

Outline of the Framework

- Vision A Vision for K-12 Science Education
- Three-Dimensions of the Framework
  - Practices of Science / Engineering
  - Crosscutting Concepts
  - Disciplinary Core Content
- Realizing the Vision

Vision for Science Education

"A vision for education in the sciences and engineering in which:

- ❑ all students
- ❑ over multiple years of school
- ❑ actively engage in science and engineering practices and
- ❑ apply crosscutting concepts
- ❑ to deepen their understanding of the core ideas in these fields."

Three-Dimensional Learning

- Scientific and Engineering Practices
- Crosscutting Concepts
- Disciplinary Core Ideas

Realizing the Vision

- Integrating the Three Dimensions
- Implementation:
  Curriculum, Instruction, Integration, Teacher Explorations, and Assessment
- Equity and Diversity in Science and Engineering Education
- Guidance for Curriculum Developers

Students learn Core Ideas by engaging in the Practices applying the Crosscutting Concepts to their ideas .

Identifying Relevant/Local Phenomenon

Analyze Performance Expectations for Big Ideas

Culture	Economics	Geography	Current Events	Endangered or threatened Species
• Festivals • Foods • Traditions • Beliefs	• Employers • Industry • Business	• [redacted] • Land formations • Water resources	• Headlines in local news • Hazards • Development	• Headlines in local news • Search endangered or threatened species in your area
Sandhill Crane Festival in Othello, Washington	Agriculture - crops in the Mid-Columbia region	Coastal erosion in the Arctic	American Samoa coral destruction after tsunami	https://wdfw.wa.gov/species-habitats/species/centrocercus-urophasianus
NGSS?	NGSS?	NGSS?	NGSS?	
Question: Why is Othello a "rest stop" on the sandhill crane migrations from Alaska and California?	Question: How does an arid region become a vegetable growing oasis?	Question: How is the land changing? What solutions should be considered?	Question: How can our community mitigate the destruction of coral in American Samoa?	Question: Why are sage grouse threatened in Tri-Cities and what can be done to support recovery?
What community resources can you leverage?	What community resources can you leverage?	What community resources can you leverage?	What community resources can you leverage?	What community resources can you leverage?
Farmers, guides, refuges, aviary, ….		.Local experts, village elders, agencies,	.	

Continue to Develop Unit and Lessons that will support NGSS

Reaching the Goal Will Require that We Change:

- The way we teach
  - What we teach
- How we assess students
- How we do Professional Learning
- How we prepare future teachers

Linda Froschauer, past Editor, "Science and Children"

"It is clear that where we are going and how we are going to get there has changed; the next steps are up to you."