Thank you!

I trust people at their word and hope you can trust me at mine.

I am working for YOU and SCIENCE EDUCATION :-)

Please call or ask questions!

amckinnon@sde.idaho.gov

Standards Implementation: Agenda

10-Intro and Reflection

10-Fortune Telling Fish!!

15-Intro to the Idaho Learning Cycle

15-The BIG shifts

5-Why we need to shift and alignment to the new assessment

10-CCC and SEP

10-The Standards and Support

15-Phenomenon

10-Relating the Standards to the ISAT

Reflection: How did YOU become the teacher you are?

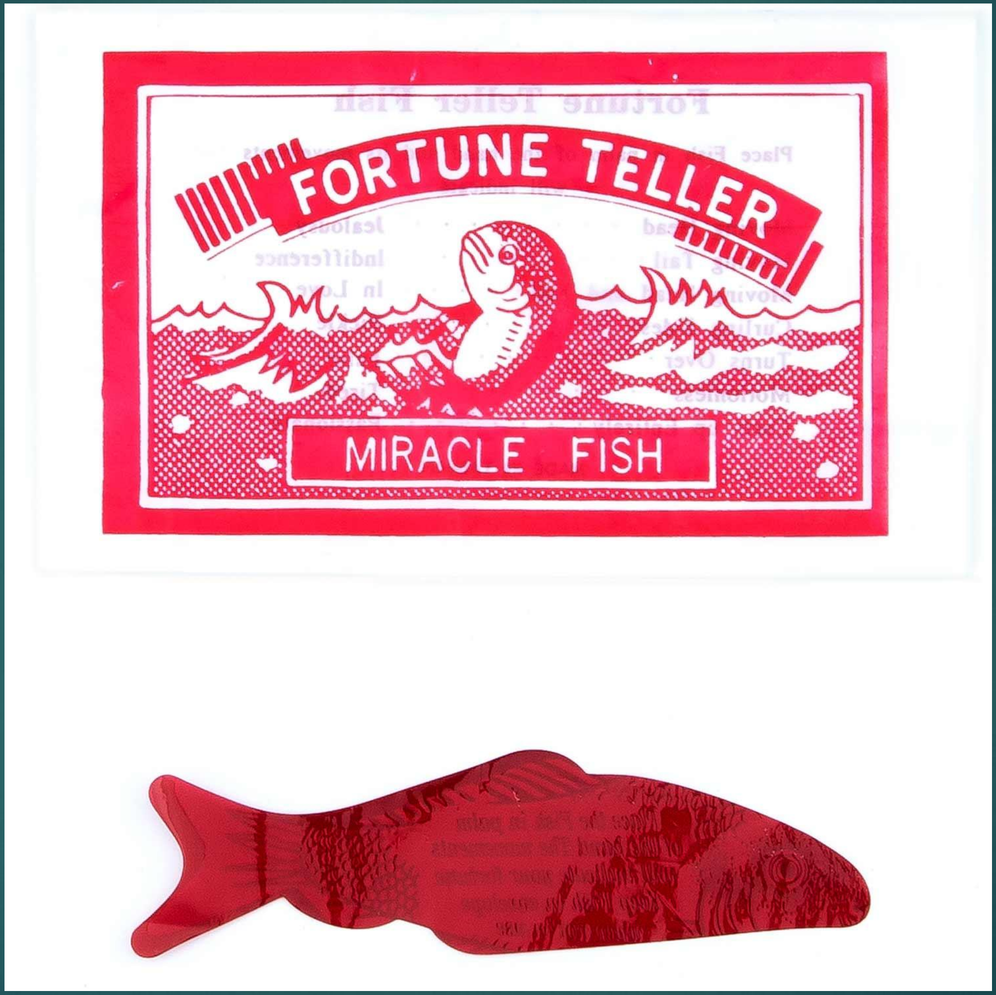
What is your definition of Science? What is your opinion of Standards? Curriculum? Performance Assessments? Grading? How have your mentors affected you?Mentors?

- Use it up, where it out, make it do, or do without…
  - Self discovery of "Standards"!2-3:00am 3 days a week
  - Vygotsky's "Zone of Proximal Development" = Learning Cycle
    - Discrepant Events ~ Phenomena!
- Mentors:
  - Fight Poverty of the Mind...and Soul
  - Be Yourself! Take a breath! Transparency is okay :-)
  - Have Fun...Always!
  - Share the Wonder; don't kill it!

Starting at the trailhead...

It is only the staging spot….
...a personal journey to your destination awaits!
(North Idaho has trees!)

?????????????????????

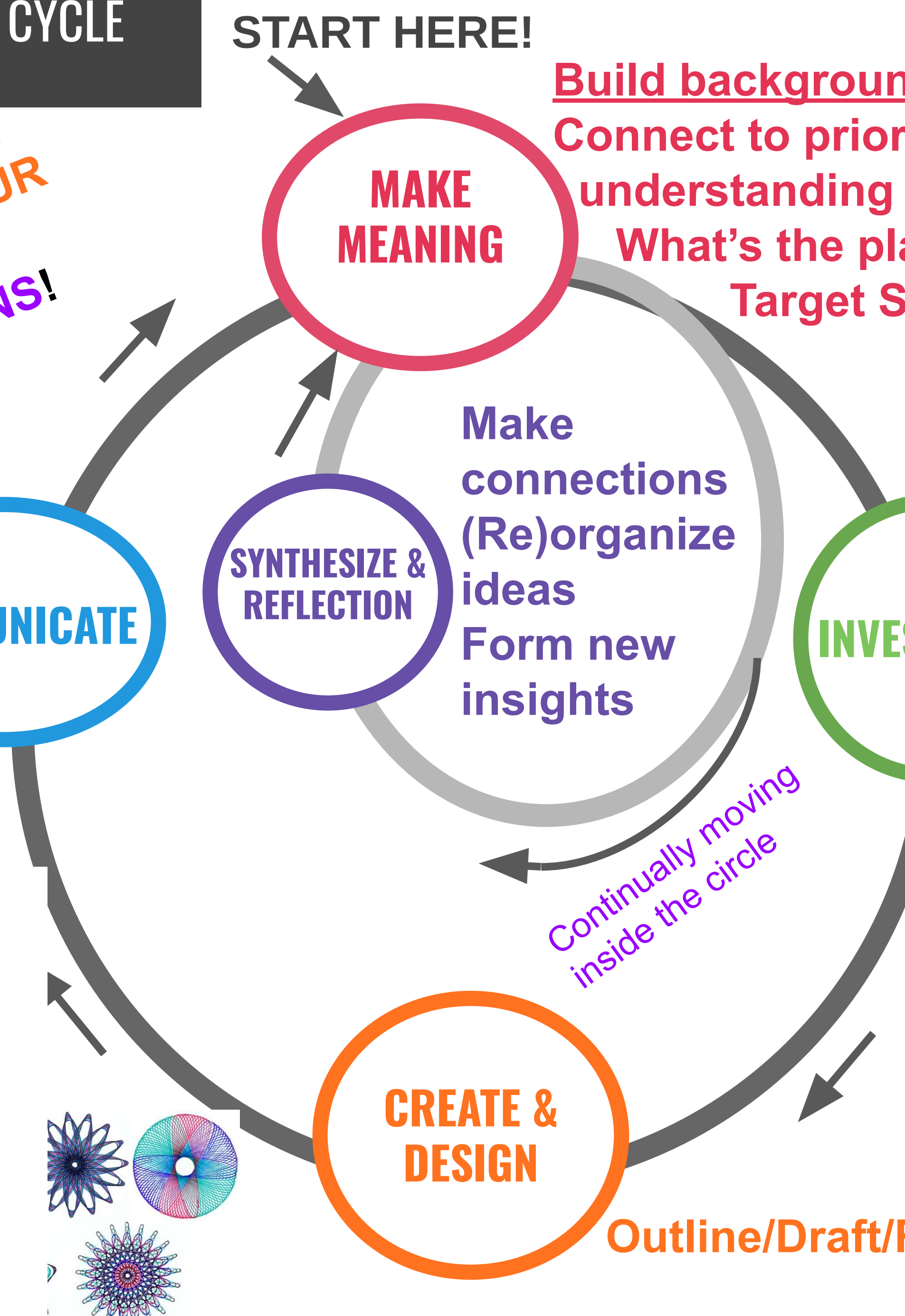


FORTUNE TELLER
MIRACLE FISH

3 Questions from the tip of your brain…

THE IDAHO LEARNING CYCLE

YOU CAN COLOR COORDINATE YOUR LESSON PROGRESSIONS!

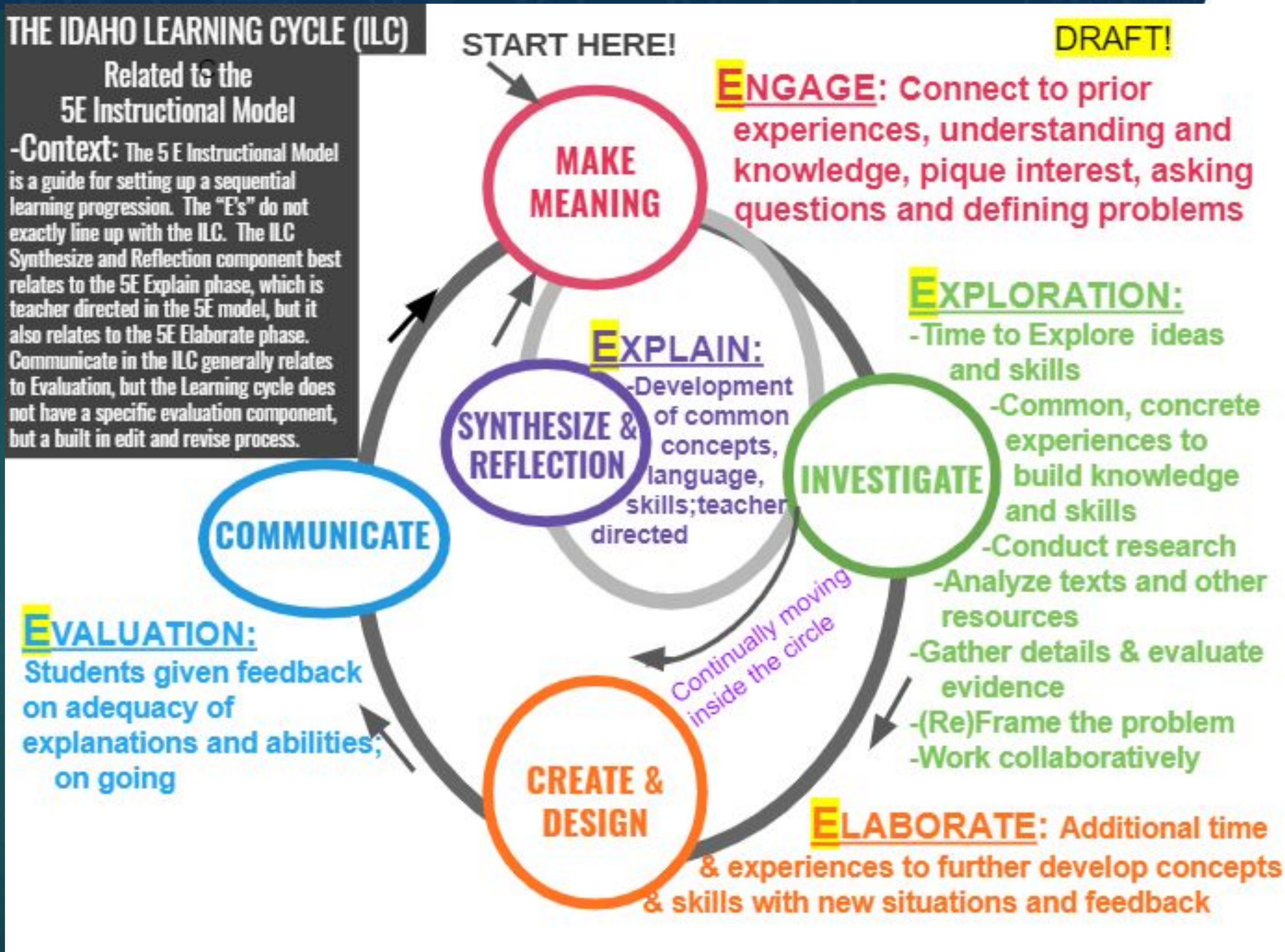


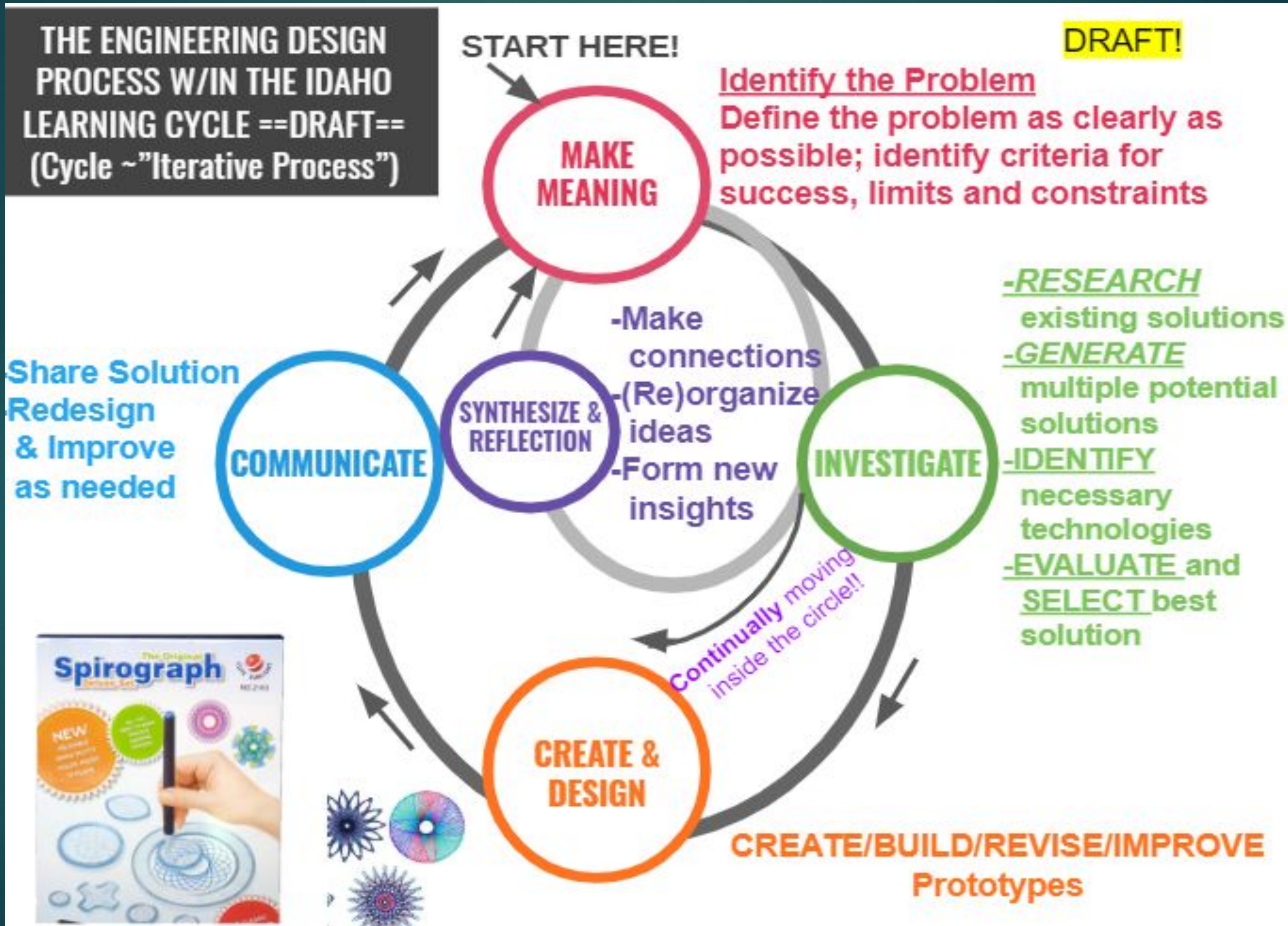
Build background:
Connect to prior experiences, understanding and knowledge;
What's the plan for learning?
Target Skills? Audience?

Ask Questions!
-Consider potential topics
-Conduct research
-Analyze texts and other resources
-Gather details & evaluate evidence
-Formulate a main Idea
-(Re)Frame the problem
-building knowledge

Outline/Draft/Revise and edit work

Practice & Prepare
Perform & Share
Publish & Reflect


THE IDAHO LEARNING CYCLE (ILC)
Related to the 5E Instructional Model
-Context: The 5 E Instructional Model is a guide for setting up a sequential learning progression. The "E's" do not exactly line up with the ILC. The ILC Synthesize and Reflection component best relates to the 5E Explain phase, which is teacher directed in the 5E model, but it also relates to the 5E Elaborate phase. Communicate in the ILC generally relates to Evaluation, but the Learning cycle does not have a specific evaluation component, but a built in edit and revise process.
START HERE!
DRAFT!
ENGAGE: Connect to prior experiences, understanding and knowledge, pique interest, asking questions and defining problems
MAKE MEANING
EXPLAIN:
-Development of common concepts, language, skills; teacher directed
SYNTHESIZE & REFLECTION
EXPLORATION:
-Time to Explore ideas and skills
-Common, concrete experiences to build knowledge and skills
-Conduct research
-Analyze texts and other resources
-Gather details & evaluate evidence
-(Re)Frame the problem
-Work collaboratively
INVESTIGATE
COMMUNICATE
EVALUATION:
Students given feedback on adequacy of explanations and abilities; on going
Continually moving inside the circle
CREATE & DESIGN
ELABORATE: Additional time & experiences to further develop concepts & skills with new situations and feedback


THE ENGINEERING DESIGN PROCESS W/IN THE IDAHO LEARNING CYCLE ==DRAFT== (Cycle ~"Iterative Process")
START HERE!
DRAFT!
MAKE MEANING
Identify the Problem
Define the problem as clearly as possible; identify criteria for success, limits and constraints
-RESEARCH existing solutions
-GENERATE multiple potential solutions
-IDENTIFY necessary technologies
-EVALUATE and SELECT best solution
INVESTIGATE
SYNTHESIZE & REFLECTION
-Make connections
-(Re)organize ideas
-Form new insights
Continually moving inside the circle!!
COMMUNICATE
-Share Solution
-Redesign & Improve as needed
CREATE & DESIGN
CREATE/BUILD/REVISE/IMPROVE Prototypes
Spirograph
NEW

Continued Personal Reflection:

- Consider moments of enlightenment regarding your instructional practices.

...I will be sharing some of mine on the following slide...

Review: The BIG Shifts

- Science and Engineering Practices and Crosscutting Concepts are *integrated* throughout the Performance Standards (K-12) and are the *driving force* for instructional practices, not content domain.
- Fewer Performance Standards and Supporting Content topics allow deeper understanding and exploration.
- Phenomenon and project/problem based learning and instructional models best correlate with the Performance Standards and state assessment.
- In preparation for Middle School and High School courses, specific content concepts are taught at specific grade levels, K-5.

WHY Crosscutting Concepts and Science and Engineering Practices Drive Science Education: Chess/Visual Connections

Novice

- Sees individual pieces and rarely make connections between them
- Sees only the “now”
- Not as engaged, only does as told

Taught WHAT Experts *KNOW*

Expert

- Sees the “big picture” and how each piece connects to others
- Sees the “before”, current and potential
- Ownership and participation

Taught HOW Experts *THINK*

Interpersonal Problem Solving Exercise:

1. Think of a personal hobby
   a. (Hint: YOU are an expert!)
2. Use the characteristics and perspective of your hobby to help your neighbor “frame” and “solve the problem”

Problem:

How can we help teachers catch a vision of the shifts represented in the new standards?

A little Vocabulary Context….

Cumulative vocabulary by Age 5

- Linguistically “poor” first graders knew 5,000 words;
- Linguistically “rich” first graders knew 20,000 words.
(Moats, 2001)link to presentation

Fact: Students will incorporate the words that teachers use frequently in the classroom.

Translation: What words will you choose to share and define their world?

Fact: Teachers _incorporate_ words they frequently use also!

“One Word” to help us remember Student Learning & Student Perspective

Can you Identify the CCC and SEP?

Crosscutting Concepts

- Ideas found in ALL science domains

1. Patterns
2. Cause and effect
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

Science & Engineering Practices

- How you DO SCIENCE

1. Asking questions (science) and defining problems (engineering)
2. Developing models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (science) and designing solutions (engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Things to consider...

- Phenomena can be connected to multiple CCC
- CCC span ***all*** grade bands
- CCC increase in complexity through higher grade bands
- CCC are found in all content areas, not just science!

Discussion and Comments

Hobby Perspective: Can you identify a couple CCC's in your hobby?

Predict the Classroom: How could you help students recognize CCC throughout the year?

Things to consider...

- SEP are interconnected and “cross over”
  - lead into each other
  - not found isolation
- SEP need intentional development and attention:
  - ex: Make and use Graphs!
  - However...explain the WHYs & HOWs

Discussion and Comments?

How could you help students recognize SEP throughout the year?

How could you use these activities in your own classroom?

ELEMENTARY SCHOOL (KINDERGARTEN)

PS: Physical Sciences

PS1-K Motion and Stability: Forces and Interactions

Performance Standards

Students who demonstrate understanding can:

PS1-K-1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

- **Further Explanation**: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.
- **Content Limit**: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets. PS1-K-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

*Link to Standards

ELEMENTARY SCHOOL (KINDERGARTEN!!!)

PS: Physical Sciences

PS1-K Motion and Stability: Forces and Interactions

Performance Standards

Students who demonstrate understanding can:

Sci & Eng Practices!

THEY'RE BUILT IN!

Cross Cutting Concepts!

PS1-K-1. **Plan** and **conduct an investigation** to **compare the effects** of different strengths or different directions of **pushes** and **pulls** on the motion of an object.

Content Area

- **Further Explanation**: Examples of push ude a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.
- **Content Limit**: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets. PS1-K-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

5th Grade Idaho State Science Standards—Instructional Support				
Content Domain	**Performance Standard**	**Summary of Supporting Content**	**Science and Engineering Practice**	**Cross Cutting Concept**
Physical Science: Matter and its Interactions	Develop a model to describe that matter is made of particles too small to be seen.	Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means.	Developing and Using Models • Develop a model to describe phenomena.	Scale, Proportion and Quantity • Natural objects exist from the very small to the immensely large.
	Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.	Mass (weight) is conserved (not lost) when materials change.	Using Mathematics and Computational Thinking • Measure and graph quantities such as weight to address scientific and engineering questions and problems.	Scale Proportion and Quantity • Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume
	Make observations and measurements to identify materials based on their properties.	Different substances have different properties (e.g., color, hardness, reflectivity, melting point, boiling point, response to magnetic forces, conductivity, solubility).	Planning and Carrying Out Investigations • Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.	
	Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	Recognize changes that indicate a chemical reaction has occurred.	Planning and Carrying Out Investigations • Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	Cause and Effect • Cause and effect relationships are routinely identified, tested, and used to explain change.
Physical Science: Motion and Stability: Forces and Interactions	Support an argument that the gravitational force exerted by Earth on objects is directed down.	Gravity causes objects to fall "down" toward the center of the planet.	Engaging in Argument from Evidence • Support an argument with evidence, data, or a model.	Cause and Effect • Cause and effect relationships are routinely identified and used to explain change
Physical Science: Energy	Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.	Since all food can eventually be traced back to plants, energy that animals use for body repair, growth, motion, and warmth is energy that once came from the sun.	Developing and Using Models • Use models to describe phenomena.	Energy and Matter • Energy can be transferred in various ways and between objects

This "page" represents Physical Science. There would also be a page for Life Science and Earth and Space Systems.

A “Summary” of a 5th Grade Science Student

Performance Standards: The performance standards in fifth grade help students formulate answers to questions such as:

- When matter changes, does its weight change?
- How much water can be found in different places on Earth?
- Can new substances be created by combining other substances?
- How does matter cycle through ecosystems?
- Where does the energy in food come from and what is it used for?
- How do lengths and directions of shadows or relative lengths of day and night change from day to day, and how does the appearance of some stars change in different seasons?”

Supporting Content Main Ideas:

- Students are able to describe that matter is made of particles too small to be seen through the development of a model.
- Students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances.
- Through the development of a model using an example, students are able to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- They describe and graph data to provide evidence about the distribution of water on Earth. Students develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water.
- Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment and that energy in animals’ food was once energy from the sun.
- Students are expected to develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Crosscutting Concepts

- The crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; energy and matter; and systems and systems models are used to organizing concepts for the Supporting Content.

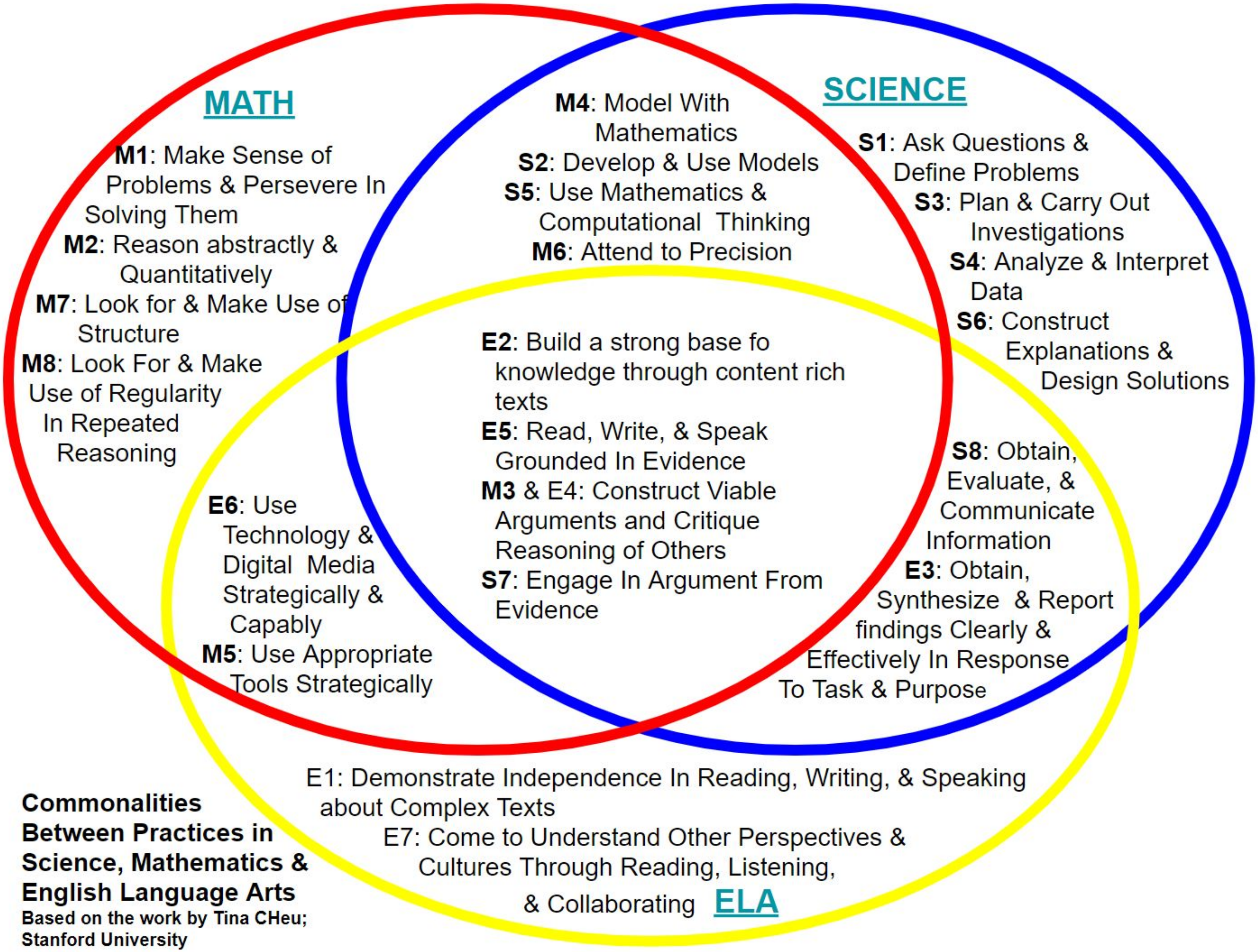
Science and Engineering Practices

- Students are expected to demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, engaging in argument from evidence, and obtaining, evaluating, and communicating information; and to use these practices to demonstrate understanding of the core ideas.

At-A-Glance Supporting Content K-5

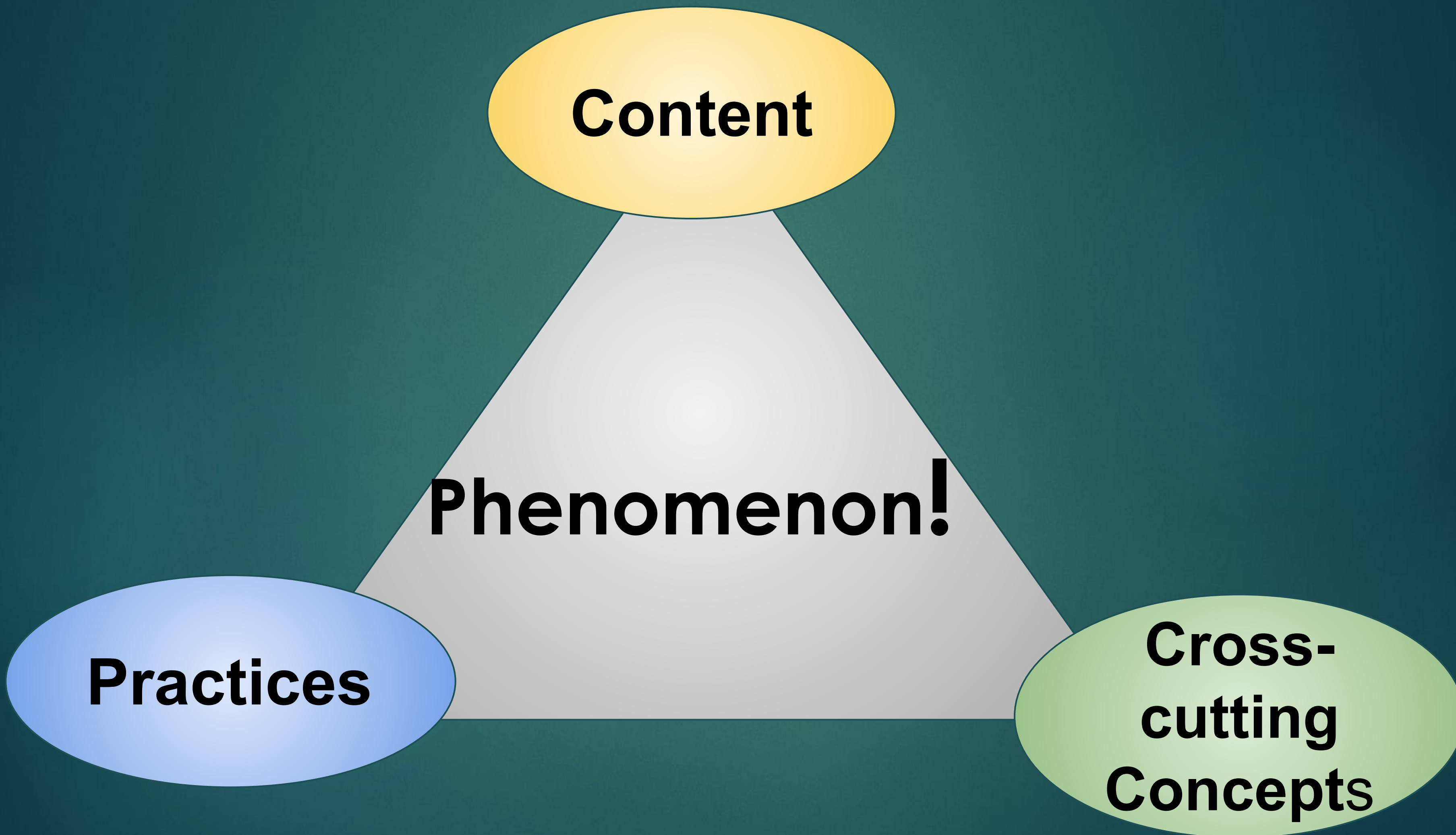
Idaho State Science Standards Supporting Content Summary At-A-Glance ===DRAFT===

	Kindergarten	First	Second	Third	Fourth	Fifth
PS: Physical Science						
Matter and Its Interactions			• Materials' observable properties, • Purpose of materials • how an object can be disassembled and made into a new object, • heating/cooling			• Matter is made of particles too small to be seen • Heating, cooling, mixing substances • Identify materials based on properties
Motion and Stability: Forces and Interactions (Note: this is K-PS2 in NGSS)	• Push/pull, speed, direction			• Balanced and unbalanced forces effect on motion, • electric/magnetic interactions, • magnets		• Gravitational force
Energy (note: this is K-PS3 in NGSS)	• Effect of sunlight				• Speed vs. Energy of object, • transfer of energy (sound, light, heat, electric), • energy when object collide, • energy conversion	• Energy from animals' food was once energy from the sun
Waves: (note: this is PS4 in NGSS)		• Sound/vibration, • dark/light			• Patterns of waves (amplitude, wavelength), • light reflect/enters eye, • transfer of information	
LS: Life Science						
Molecules to Organisms: Structures and Processes	• What plants and animals need to survive, • living/non-living (not in NGSS)	• plants and animals use external parts to survive, • parent/offspring, • life cycle (not in NGSS)		• Life cycles (in NGSS only at this grade, see Idaho first grade)	• Plants/Animals have internal and external structures to support survival, growth, behavior & reproduction; • receive information through senses, process in brain, respond to information	• plants get material they need for growth chiefly from air and water
Ecosystems: Interactions, Energy, and Dynamics (this is LS2 in NGSS)			• Plants need sunlight, seed dispersion, plant pollination	• Some animals form groups that help members survive,	• Movement among plants, animals, decomposers and the environment (in 5th grade NGSS)	
Heredity: Inheritance and Variation of Traits (Note: this is LS3 in NGSS)		• Young are like/different from parents		• Plants and animals have traits inherited from parents and variation of these traits exists in a group of similar organisms. • Traits can be influenced by environment		
Biological Adaptation (Evolution): Unity and Diversity (note: this is 3-LS4-1 in NGSS)			• Plants/animals diversity in different habitats.	• See 5th grade		• Fossils provide evidence of organisms and environment • Variations in characteristic may provide advantages in surviving, finding mates, and reproducing • In a particular habitat, some organisms can survive well, some less well, and some not at all • Problem caused when the environment changes and the types of plants and animals that live there may change (3rd Grade NGSS)
ESS: Earth and Space Science						
Earth's Place in Universe		• Patterns of Sun, Moon, Stars • amount of daylight @ different times of year	• Earth events can occur quickly or slowly.	• Typical weather conditions expected in a season, • climate in the world	• Rock formations and fossils in rock layers/ changes in a landscape over time	• Apparent brightness of sun vs. stars • Shadows, day and night, seasonal appearance of stars
Earth's Systems (note: this is ESS2 in NGSS)	• Weather, four seasons, • how plants and animals change the environment		• Effects of wind/water, • shapes and kinds of land and bodies of water, • where water is on Earth (solid, liquid, gas) no gas in NGSS	• Weather related hazard, solution	• Weathering and Erosion by water, ice, wind, or vegetation • Data from maps to describe patterns of Earth's features	• Geosphere, biosphere, hydrosphere, atmosphere • Distribution of water
Earth and Human Activity (note: this is ESS3 in NGSS)	• Needs of plants/animals and places they live, • weather forecasting, severe weather, • impact of humans on the environment.			• Typical weather conditions expected in a season, • climate in the world	• Energy and fuels are derived from natural resources and their uses affect the environment. • Impacts of natural Earth processes on humans	• Ways communities use science ideas to protect the Earth's resources and environment.



Commonalities Between Practices in Science, Mathematics & English Language Arts
Based on the work by Tina CHeu; Stanford University

What connects the Practices, Crosscutting Concepts and Content?



Definition of Phenomenon

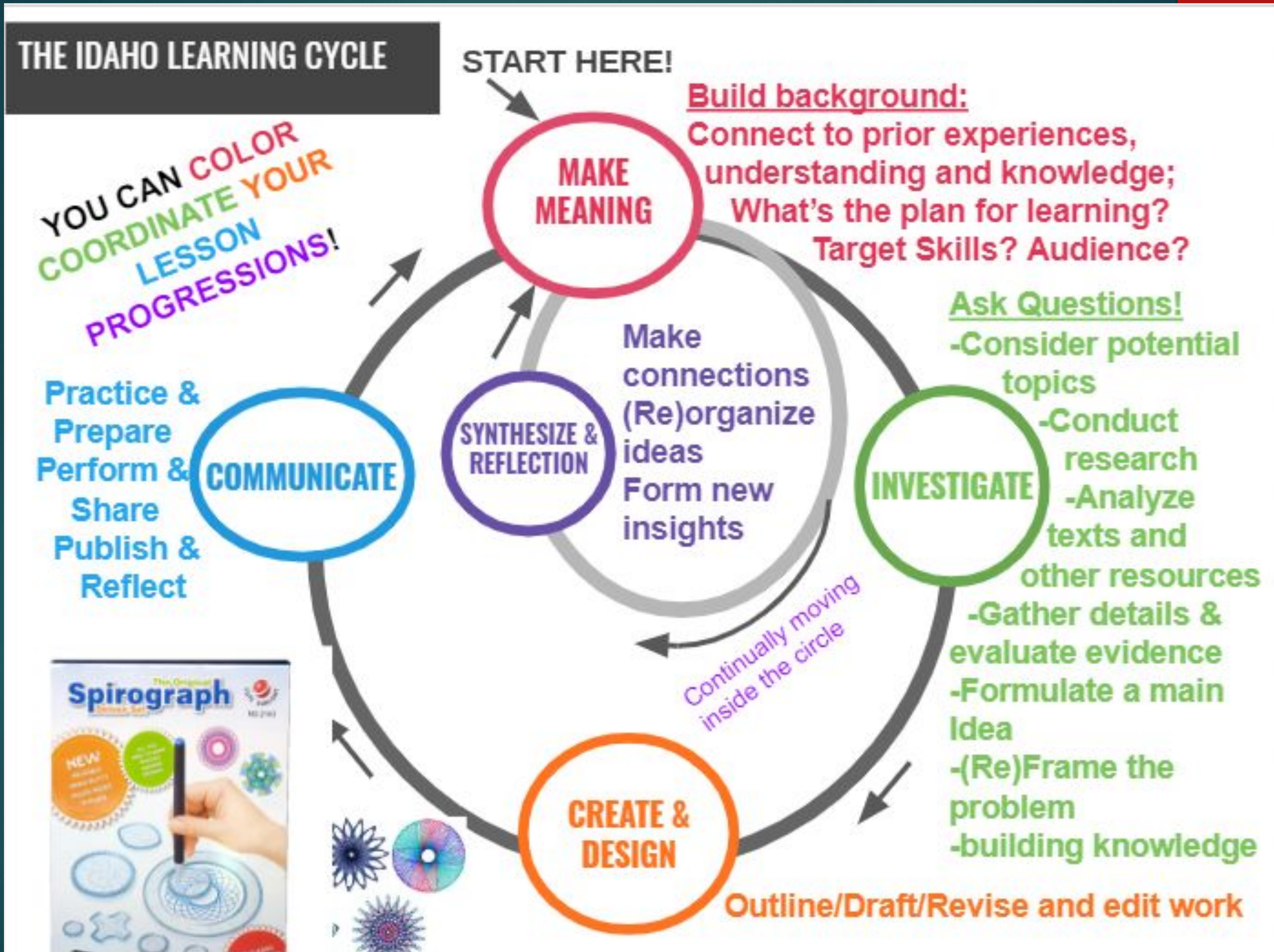
Phenomena are something observed in the natural or human-made world that causes us to wonder and ask questions.

The “wonderment” spurs engagement, leading to questions and then seeking answers.

The Role of Phenomenon

The phenomena used for designing and guiding instructional resources needs to engage, promote wonder and provide multiple opportunities to make sense of the world. After experiencing a phenomenon, learners should have a sense of wonderment about why the phenomenon occurred and ask questions such as “What could have caused that to happen?” “What can I do to change conditions so that it this doesn’t reoccur?” “What can I do to ensure this stays the same way?” (Krajcik and Czerniak, 2018).

Krajcik, J.S., & Czerniak, C., (2018). Teaching Science in Elementary And Middle School Classrooms: A Project-Based Learning Approach, Fifth Edition. Routledge, Taylor and Francis Group: New York & London.


THE IDAHO LEARNING CYCLE
START HERE!
YOU CAN COLOR COORDINATE YOUR LESSON PROGRESSIONS!
MAKE MEANING
Build background:
Connect to prior experiences, understanding and knowledge;
What's the plan for learning?
Target Skills? Audience?
Ask Questions!
-Consider potential topics
-Conduct research
-Analyze texts and other resources
-Gather details & evaluate evidence
-Formulate a main Idea
-(Re)Frame the problem
-building knowledge
INVESTIGATE
SYNTHESIZE & REFLECTION
Make connections
(Re)organize ideas
Form new insights
Continually moving inside the circle
CREATE & DESIGN
Outline/Draft/Revise and edit work
COMMUNICATE
Practice &
Prepare
Perform &
Share
Publish &
Reflect
Spirograph

The Role of Phenomenon

The phenomena used for designing and guiding instructional resources needs to engage, promote wonder and provide multiple opportunities to make sense of the world. After experiencing a phenomenon, learners should have a sense of wonderment about why the phenomenon occurred and ask questions such as “What could have caused that to happen?” “What can I do to change conditions so that it this doesn’t reoccur?” “What can I do to ensure this stays the same way?” (**Krajcik** and Czerniak, 2018).

Krajcik, J.S., & Czerniak, C., (2018). Teaching Science in Elementary And Middle School Classrooms: A Project-Based Learning Approach, Fifth Edition. Routledge, Taylor and Francis Group: New York & London.

Phenomena Literacy: More than meets the eye!

Types of Phenomena

***Anchor* Phenomenon**: *Anchor* phenomena provide focus for the overall unit. They typically require a deep understanding of several science ideas.

***Investigative* Phenomenon**: *Investigative* phenomena are the focus of an instructional sequence or lesson. They give students personal experience with observable events to help explain aspects of the anchoring phenomena.

Daily Phenomena: self-explanatory!

Phenomena Literacy:
More than meets the eye!

<u>**Characteristics of Quality Phenomena**</u>

- Engaging to ALL students
  - Culturally or Personally Relevant
  - Every day observations, daily, family experiences, what students do or come from
  - Audience that cares about the results or products
- Consequential to students; deep
- Stretch student learning, but not too far; aligned to grade bands
- Does not have to be “*Flashy*” or “*Phenomenal*”
  - Can be a case or some that is puzzling or wonderment
- Helpful to teachers in meeting multiple standards, yet discrete
- Allows for a range of ideas and good source of relevant data, images, and text to engage students; allow broad sequence of SEP and first-hand or second-hand investigations

Take a breath and enjoy!

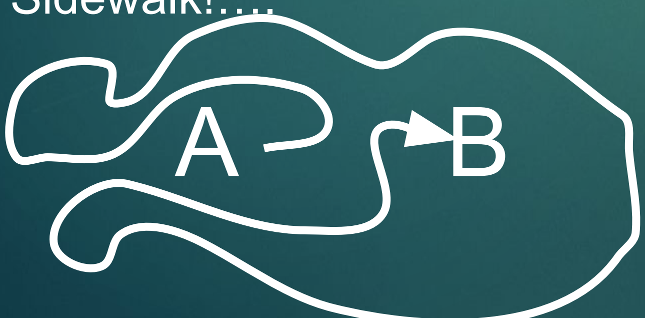
Phenomena Literacy:
More than meets the eye!

How phenomenon develop: 2 perspectives

An observation does not always a phenomenon make

Round-a-bout method

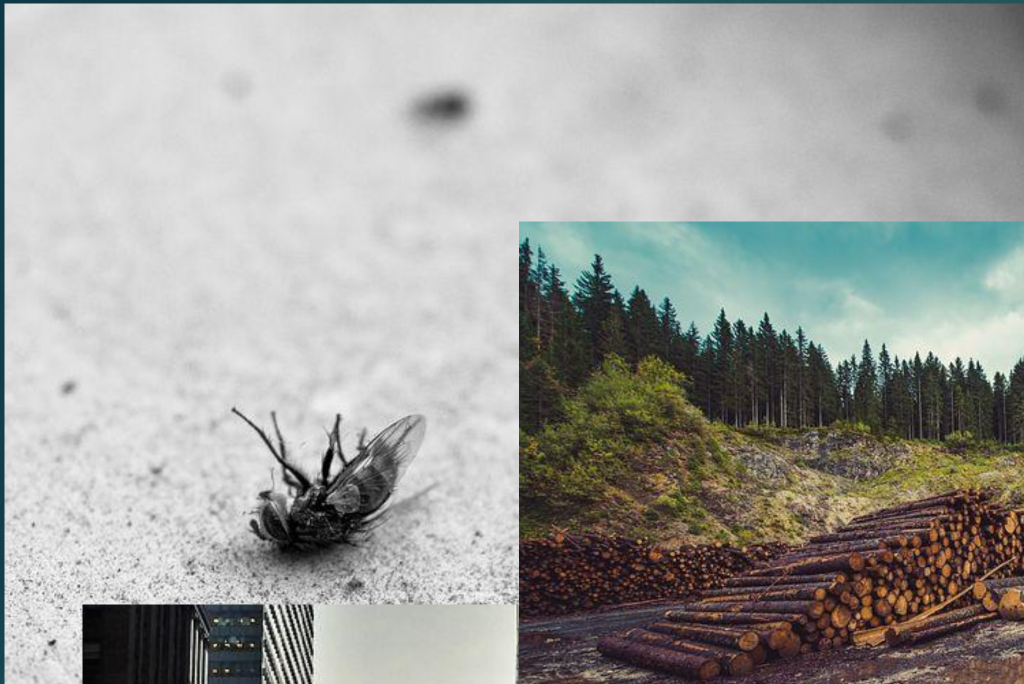
- Start where you are...pick an observation, any observation…
- The random journey to quality phenomena...how does it connect to SEP, CCC, Supporting Content, course sequence, data collection or availability, etc
- Ex: Dead Flies or Worms on the Sidewalk!….



Standardized Method

- Start with a SEP or CCC
  - The walls of your Phenomenon Development
- What phenomena aligns?
- What Practices does the Performance Standard outline?
- Ex:

$A \rightarrow B$








Assessment Standards Connection Summary:

Assess the WAY you teach and teach the WAY you assess.

Informed by Linda Darling Hammond and Ray Pecheone (Stanford)

Understanding the standards…
…It's not cheating!

Sci & Eng Practices!

THEY'RE BUILT IN!

Cross Cutting Concepts!

PS1-K-1. **Plan** and **conduct an investigation** to **compare the effects** of different strengths or different directions of **pushes** and **pulls** on the motion of an object.

Content Area

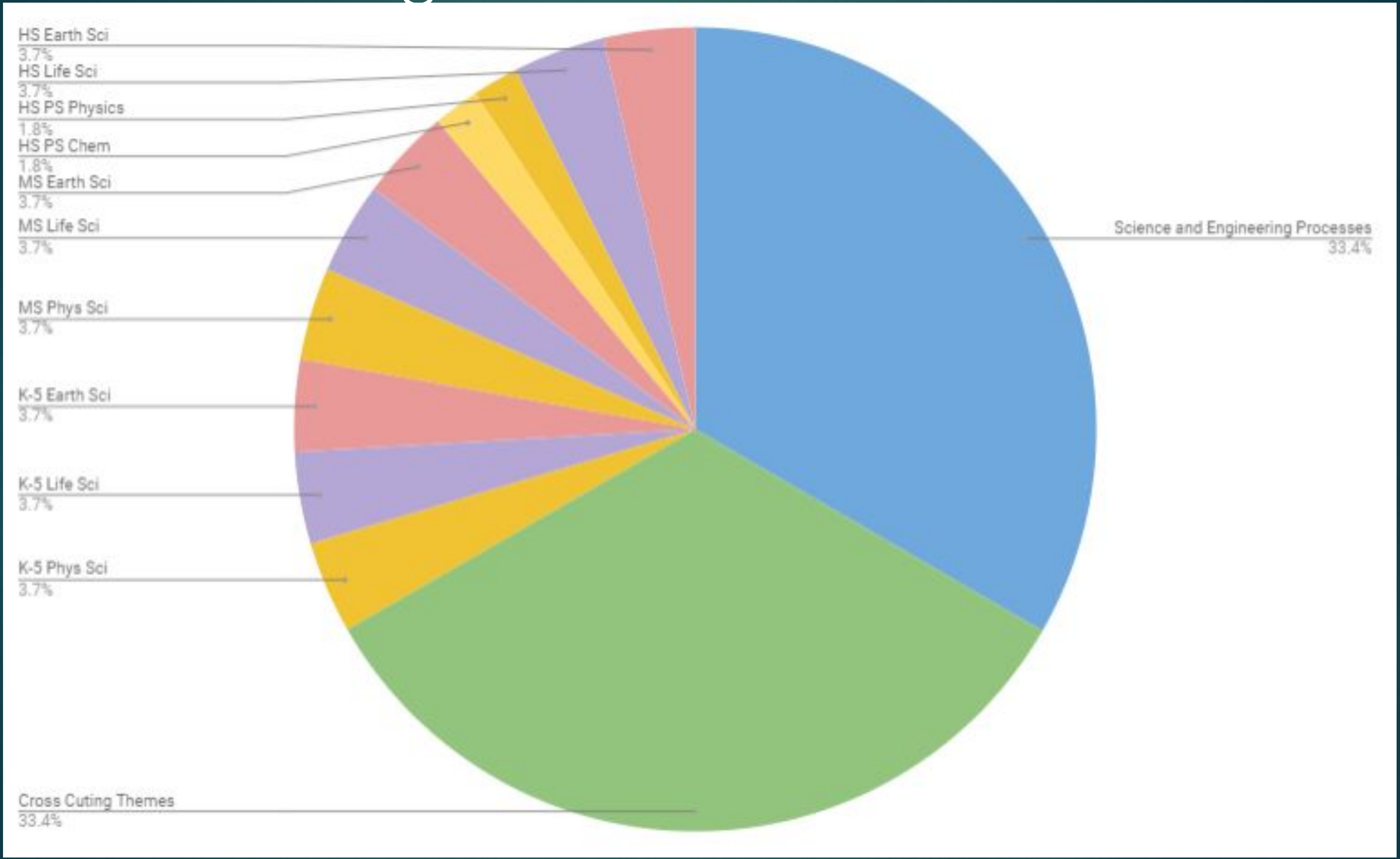
Phenomenon + Standards

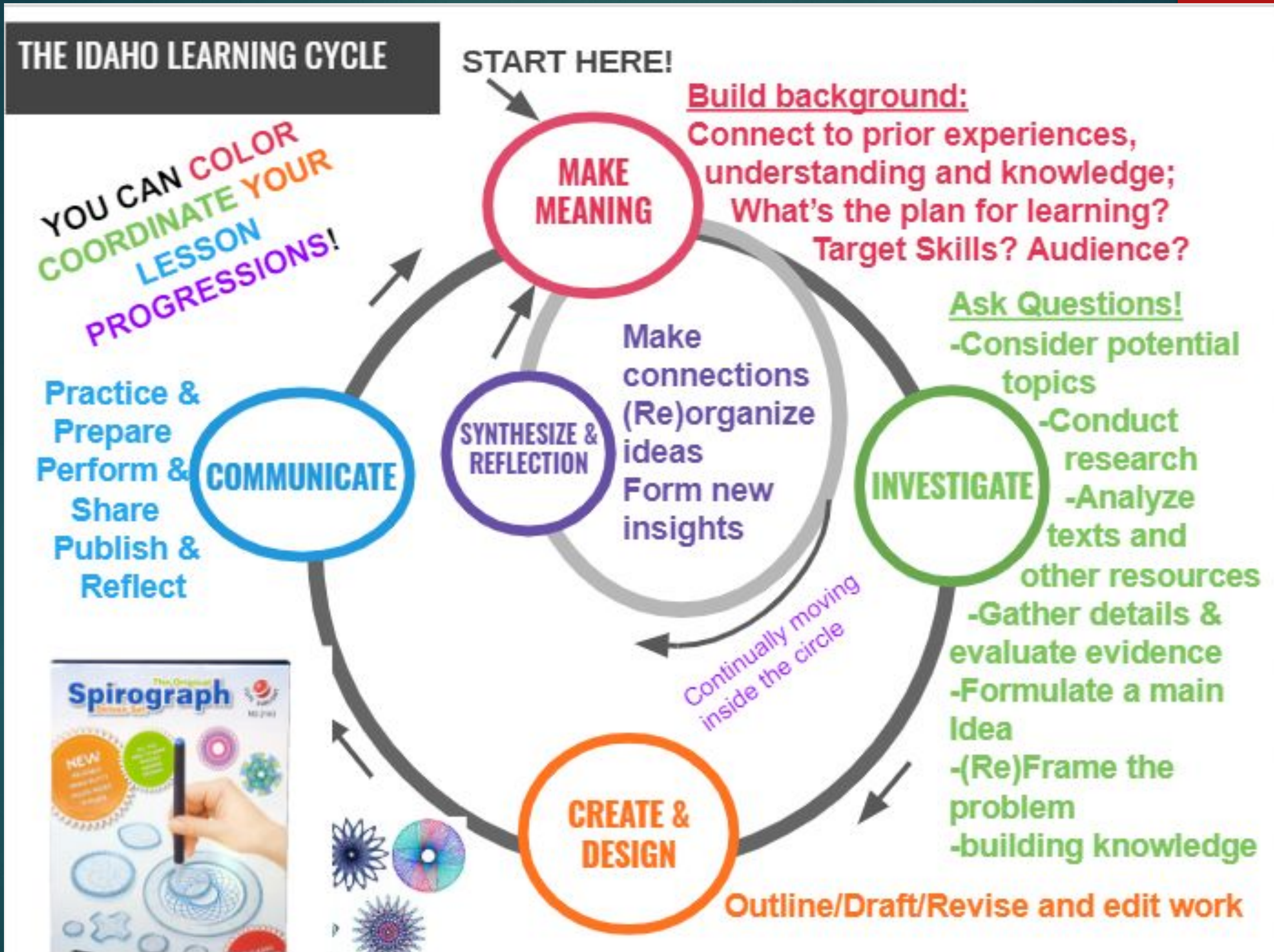
=

Assessment Pool of Resources!

What? I have to read the instructions?
Man McKinnon, why you make me work so hard?

Assessment breakdown…SEP and CCC thinking is essential!




THE IDAHO LEARNING CYCLE
START HERE!
YOU CAN COLOR COORDINATE YOUR LESSON PROGRESSIONS!
MAKE MEANING
Build background:
Connect to prior experiences, understanding and knowledge;
What's the plan for learning?
Target Skills? Audience?
Ask Questions!
-Consider potential topics
-Conduct research
-Analyze texts and other resources
-Gather details & evaluate evidence
-Formulate a main Idea
-(Re)Frame the problem
-building knowledge
INVESTIGATE
Make connections
(Re)organize ideas
Form new insights
SYNTHESIZE & REFLECTION
Continually moving inside the circle
CREATE & DESIGN
Outline/Draft/Revise and edit work
COMMUNICATE
Practice &
Prepare
Perform &
Share
Publish &
Reflect
Spirograph

How does the Fortune Telling Fish Fit In?

Does it have potential to be a phenomena? What type?

Can you link it to CCC and SEP? Which ones?

Does it fit with Supporting Content and Specific Standards?

Take A-Ways...

- Meeting the demands of teaching is not an easy task; personal insight is valuable!
- The shifts the new standards represent are monumental, but exciting and worthwhile
  - Standards and Phenomena Literacy is essential
  - Mindset and Support from all stakeholders is essential (Teachers, Students, Admin, Parents, etc.
- Phenomena allow an entry point to initiate the Learning Cycle and keep it progressing.
- Phenomena connect the three components of science education.
- The New Science ISAT reflects the standards!

Thank you!

I trust people at their word and hope you can trust me at mine.

I am working for YOU and SCIENCE EDUCATION :-)

Please call or ask questions!

amckinnon@sde.idaho.gov

Phenomena Literacy: BONUS! More than meets the eye!

Sources for Phenomena

- Phenomenon Resources
  - Supportive site + list: https://thewonderofscience.com/phenomenal
  - Master List: https://docs.google.com/document/d/1vyOQBzVugeDj13IMHZDN4QNOg5DQpm_E9h28yTJ2M-g/edit
  - Assessments : https://ngss-assessment.portal.concord.org/ngsa-collections
  - Stanford: https://snapgse.stanford.edu/snap-assessments-ngss
  - List:https://sites.google.com/site/sciencephenomena/search
  - List of: https://www.ngssphenomena.com/
  - Heuristic on how to create: https://www.ngssphenomena.com/how-to-use-phenomena
  - Amazing resources, adaptable to phenomenon and inquiry https://www.sciencefriday.com/educational-resources/hungry-hungry-hermetia/

Phenomena Literacy:
More than meets the eye!

Better Understanding Phenomenon

- Josh Smith: Phenomenon.Science ◦https://phenomenon.science/
- Basics NGSS: https://www.nextgenscience.org/resources/phenomena
- Stem Teaching tools: http://stemteachingtools.org/brief/42
- Anchor vs investigative: https://docs.google.com/document/d/1Nx9XZCvAZW98yEfs7VNW2jW4R0hmcPXuT4nz7F-YBsA/edit
- Process: https://docs.google.com/document/d/1LzVmLe71dK84hwUfjKh0-XG5wQmUCfcnv_t6LFAPdY8/edit
- Sci Socratic dialogue:
  - ttps://www.knowatom.com/blog/why-is-socratic-dialogue-so-important-in-a-next-generation-science-classroom
  - https://www.knowatom.com/blog/5-features-of-all-socratic-dialogues