



# Montana

## Office of Public Instruction

**Formative Assessment for Science: PAO in Action  
Process . Assessment . Outcome**

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**2020 Data & Assessment “ASSIST” Conference  
Delta Hotels, Helena . January 13, 2020**

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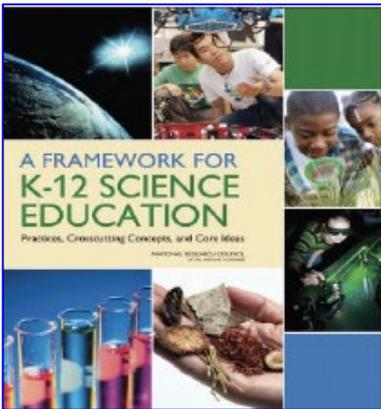


# Session Objectives

- History of Science Standards
- Science Action Plan
- PAO Instruction
- Science Resource Repository

# History of Science Standards in MT

- Last Science Standards adoption was in 2006.
- In 2009, the Essential Learning Expectations (ELE's) were written in an effort to provide guidance and support for teachers.
- MT NGSS Lead State of 26.



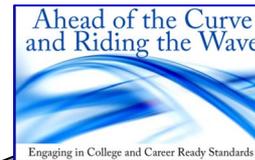
**2012:**  
 Publication of *A Framework for K – 12 Science Education*



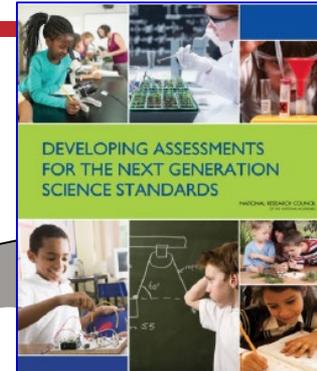
**2013:**  
 Publication of *Next Generation Science Standards (NGSS)*



**2013:**  
 A critical look at NGSS for Montana and verification of gap analysis.

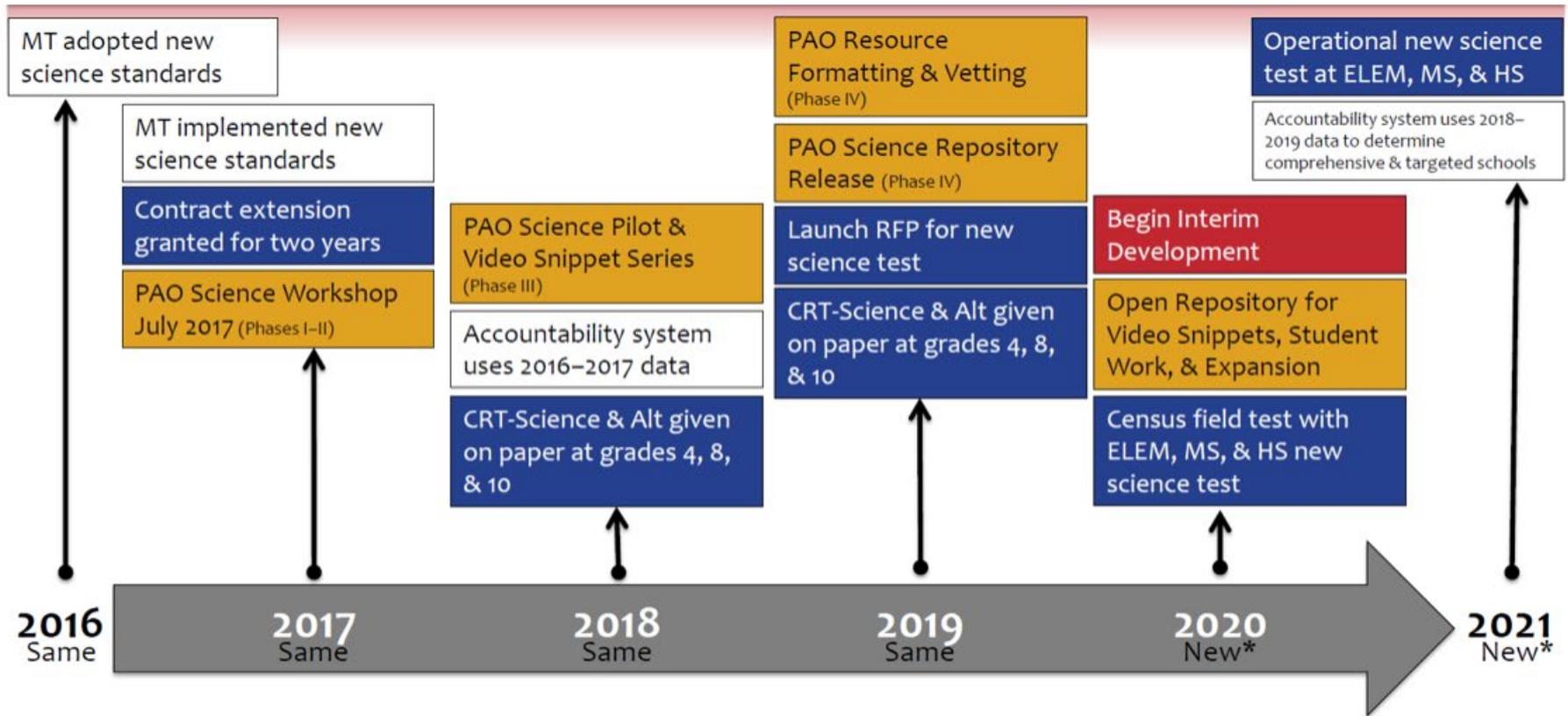


**2014:**  
 NAEP Item Classification Study



**2014:**  
 NRC Report Published on Assessments for NGSS identifies NAEP as a potential exemplar

# Action Planning and Roll Out

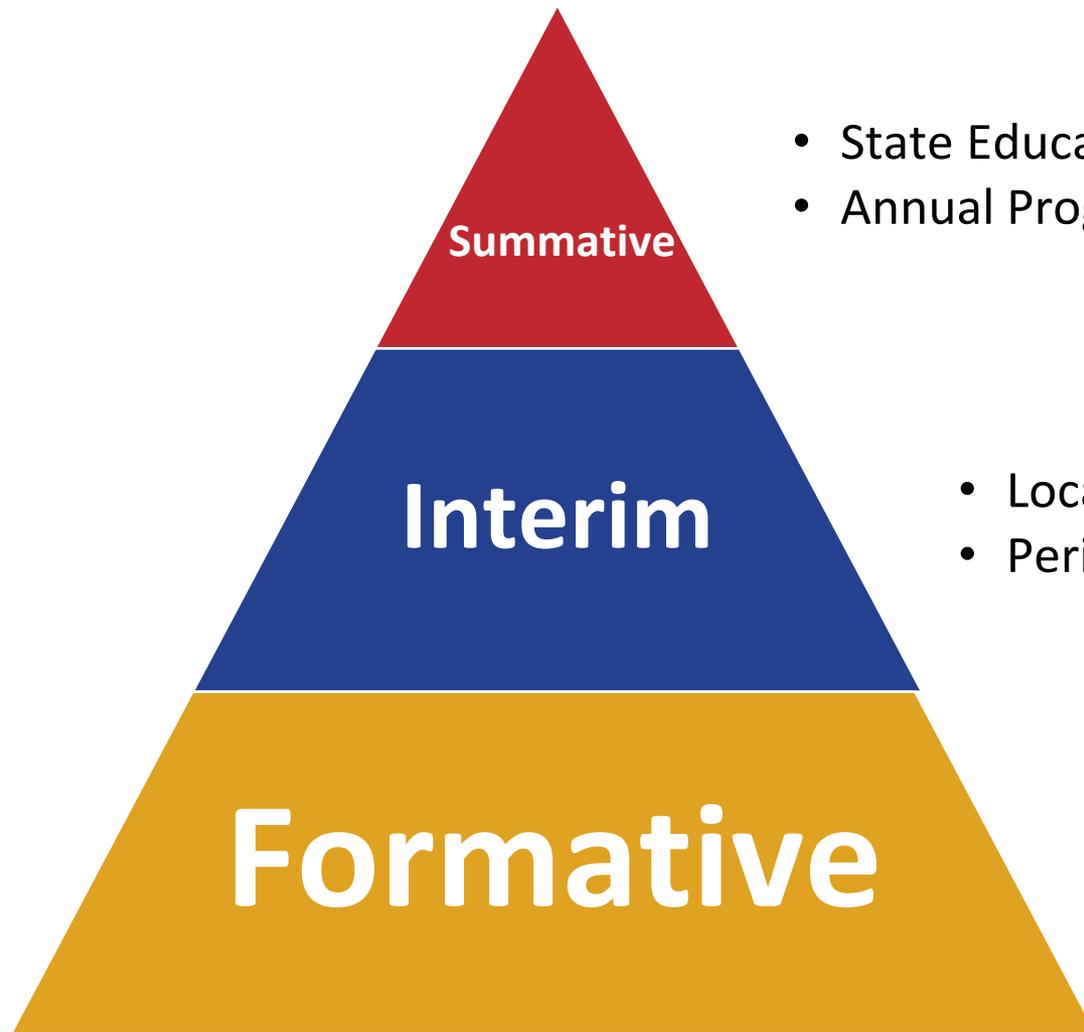


# What is PAO Science?



Process • Assessment • Outcome

# Theory of Action Vision

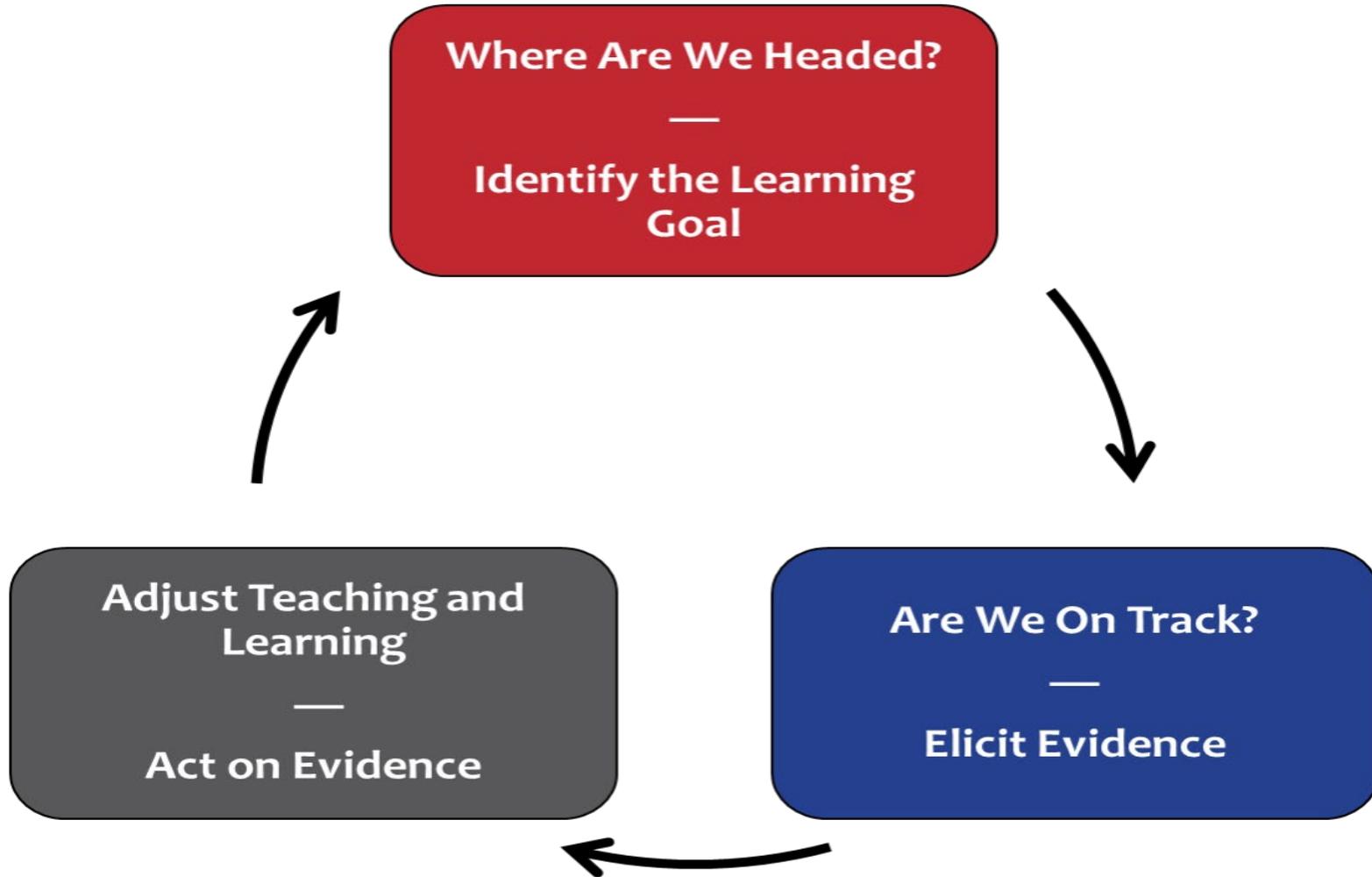


- State Education Agency
- Annual Progress Snapshot

- Local Education Agency
- Periodic Predictor

- Teachers & Students
- Frequent Feedback

# PAO Formative Assessment



- **Formative Assessment** - is a deliberate process used by teachers and students during instruction that provides actionable feedback used to adjust ongoing teaching and learning strategies to improve students' attainment of curricular learning targets/goals.

# Methods



PAO Phases I – IV

# Methods Outline

- **PAO Phase I (Online)**

- Material Selection
- Teacher Selection – 30
- Online Training
- Four-Page Form

- **PAO Phase II (In-Person)**

- Three-day Workshop

- **PAO Phase III (In the Classroom)**

- Pilot Resources
- Video Snippet Series
- Template Resources

- **PAO Phase IV (To Be Determined)**

- Merge and finalize all resources
- Review online repository
- Create action plan



# PAO Phase I

- Material Selection
- Teacher Selection
- Online Training
- Four-Page Form



# PAO Phase II

- Three-Day Workshop



# PAO Phase III

- Pilot Resources
- Video Snippet Series
- Template Resources



# PAO Goals

- Test the resource template
- Test the process with rubrics and checklist
- Elicit input from piloting teacher
- Revise materials as necessary



# Moving Forward

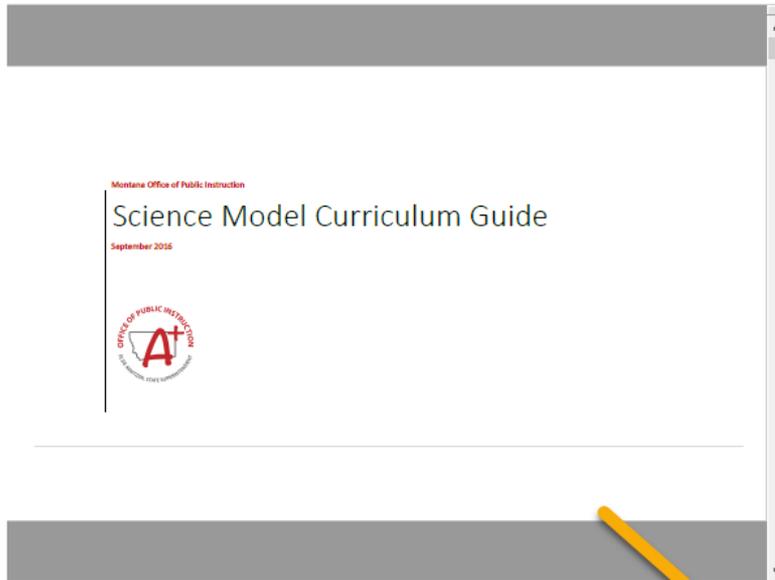
## Science Resource Repository



# Science Standards

## Content Standards and Model Curriculum Guide Documents

Science Instructional Coordinator [Michelle McCarthy](#) | 406-444-3537  
 Return to [K-12 Content Standards homepage](#)



### MT Science Standards

- [K-12](#)

### Model Curriculum Guides

- [K-12](#)
- [Kindergarten](#)
- [First Grade](#)
- [Second Grade](#)
- [Third Grade](#)
- [Fourth Grade](#)
- [Fifth Grade](#)
- [Sixth to Eighth, Earth and Space](#)
- [Sixth to Eighth, Life Science](#)
- [Sixth to Eighth, Physical Science](#)
- [Ninth to Twelfth, Earth and Space](#)
- [Ninth to Twelfth, Life Science](#)
- [Ninth to Twelfth, Physical Science](#)

### Sample Science

#### Assessment Items

\*\* [Practice Test](#) \*\*

More [AIR Assessment](#) views

### Comparison Document NGSS vs MT

The Science Resource Repository has available [Repository by Topic](#) which compares NGSS with the MT Science standards and makes available

# Science Resource Repository

**NAVIGATION**

- HOME
- START HERE
- EXPLORE THE REPOSITORY BY TOPIC**
- GRADE
- SCIENCE DOMAIN
- PRACTICES
- CROSSCUTTING CONCEPTS
- INDIAN EDUCATION FOR ALL
- SUBMIT A FORMATIVE RESOURCE
- SUBMIT SAMPLE STUDENT WORK
- ACKNOWLEDGEMENTS
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Explore the Repository by Topic

Use the following spreadsheet to sort and filter the Montana Content Standards (2016) for science and to identify any available formative assessments within the repository.

**EXPLORE THE REPOSITORY BY TOPIC**

Explore the Repository by Topic.xlsx

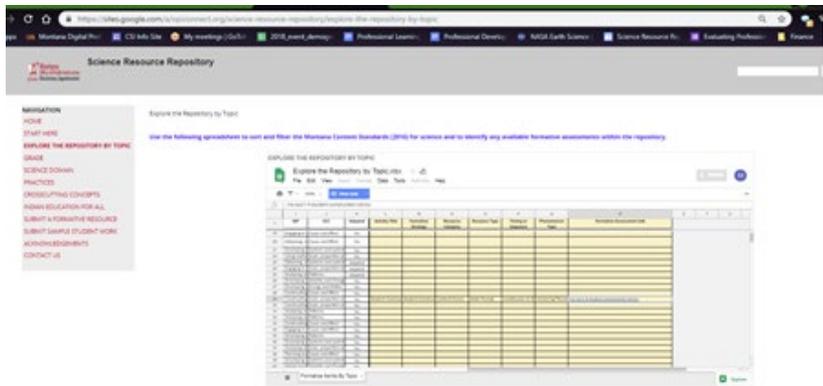
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1	A	B	C	D	E	F	G	H	I	J	K
1	Topic	Storyline Questions	Grade	Science Domain	NISS Standard	PE	Montana Adapted Performance Standard	DO	SEP	CCC	Adaptive
2	4 Weather and Climate	What is the weather like today?	4 Kindergarten	Earth and Space Science	4.ESS2.1	PS	use and share observations of local weather conditions	ESS2.D	Analyzing and Interpreting	Patterns	Yes
3	4 Weather and Climate	What is the weather like today?	4 Kindergarten	Earth and Space Science	4.ESS2.2	PS	construct an argument supported by evidence for a claim	ESS2.B	Engaging in Argument from Evidence	Systems and Systems	Yes
4	4 Weather and Climate	What is the weather like today?	4 Kindergarten	Earth and Space Science	4.ESS2.3	PS	use a model to represent the relationship between the sun, the earth, and the moon	ESS1.A	Developing and Using Models	Systems and Systems	Yes
5	4 Weather and Climate	What is the weather like today?	4 Kindergarten	Earth and Space Science	4.ESS2.4	PS	ask questions to obtain information about the earth	ESS3.B	Obtaining, Evaluating, and Communicating Information	Cause and Effect	Yes
6	4 Weather and Climate	What is the weather like today?	4 Kindergarten	Earth and Space Science	4.ESS2.5	PS	communicate ideas about the impact of humans on the earth	ESS3.C	Obtaining, Evaluating, and Communicating Information	Cause and Effect	Yes
7	1 Space Systems, Patterns and Change	What objects are in the sky and what objects are in the sky and what	1 First Grade	Earth and Space Science	1.ESS1.1	PS	use observations of the sun, moon, and stars to describe their patterns in the sky	ESS1.A	Analyzing and Interpreting	Patterns	Yes
8	1 Space Systems, Patterns and Change	What objects are in the sky and what	1 First Grade	Earth and Space Science	1.ESS1.2	PS	make observations or predictions about objects in the sky	ESS1.B	Engaging in Argument from Evidence	Patterns	Yes
9	2 Earth's Systems, Processes and Change	How does land change and what	2 Second Grade	Earth and Space Science	2.ESS2.1	PS	use information from several sources to provide evidence	ESS1.C	Constructing Explanations and Designing Solutions	Stability and Change	Yes
10	2 Earth's Systems, Processes and Change	How does land change and what	2 Second Grade	Earth and Space Science	2.ESS2.2	PS	construct explanations to compare multiple physical processes	ESS2.A	Constructing Explanations and Designing Solutions	Stability and Change	Adaptive
11	2 Earth's Systems, Processes and Change	How does land change and what	2 Second Grade	Earth and Space Science	2.ESS2.3	PS	develop models to represent the shape and kinds of objects in the sky	ESS2.B	Developing and Using Models	Patterns	Yes
12	2 Earth's Systems, Processes and Change	How does land change and what	2 Second Grade	Earth and Space Science	2.ESS2.4	PS	obtain information to identify where water is found	ESS2.C	Obtaining, Evaluating, and Communicating Information	Patterns	Yes
13	3 Weather and Climate	What is typical weather in different	3 Third Grade	Earth and Space Science	3.ESS3.1	PS	obtain and represent data using tables and graphs	ESS2.D	Analyzing and Interpreting	Patterns	Adaptive
14	3 Weather and Climate	What is typical weather in different	3 Third Grade	Earth and Space Science	3.ESS3.2	PS	obtain and combine information to describe climate	ESS2.D	Obtaining, Evaluating, and Communicating Information	Patterns	Yes
15	3 Weather and Climate	What is typical weather in different	3 Third Grade	Earth and Space Science	3.ESS3.3	PS	make a claim based on information about the world	ESS3.B	Engaging in Argument from Evidence	Cause and Effect	Yes
16	4 Earth's Systems, Processes and Change	How can water, air, wind and other	4 Fourth Grade	Earth and Space Science	4.ESS4.1	PS	identify evidence from patterns in rock formations and fossils to describe past environments	ESS1.C	Constructing Explanations and Designing Solutions	Patterns	Yes
17	4 Earth's Systems, Processes and Change	How can water, air, wind and other	4 Fourth Grade	Earth and Space Science	4.ESS4.2	PS	make observations or measurements to provide evidence	ESS2.A	Planning and Designing	Cause and Effect	Yes
18	4 Earth's Systems, Processes and Change	How can water, air, wind and other	4 Fourth Grade	Earth and Space Science	4.ESS4.3	PS	analyze and interpret data from maps to describe patterns of Earth's features	ESS2.B	Analyzing and Interpreting	Patterns	Yes
19	4 Earth's Systems, Processes and Change	How can water, air, wind and other	4 Fourth Grade	Earth and Space Science	4.ESS4.4	PS	generate and compare multiple solutions to reduce the effects of weather or climate change	ESS3.B	Engaging in Argument from Evidence	Cause and Effect	Yes
20	4 Energy	How do waves and what are they	4 Fourth Grade	Earth and Space Science	4.ESS4.5	PS	obtain and combine information from a variety of sources to describe patterns of Earth's features	ESS3.A	Obtaining, Evaluating, and Communicating Information	Cause and Effect	Yes
21	3 Earth's Systems	How do lengths and directions of	3 Fifth Grade	Earth and Space Science	3.ESS3.1	PS	develop a model using an example to describe what happens at different scales and proportions	ESS2.A	Developing and Using Models	Systems and Systems	Yes
22	3 Earth's Systems	How do lengths and directions of	3 Fifth Grade	Earth and Space Science	3.ESS3.2	PS	graph and explain the proportion and quantities of objects and systems at different scales	ESS2.A	Using Mathematical and Computational Thinking	Systems and Systems	Yes
23	3 Earth's Systems	How do lengths and directions of	3 Fifth Grade	Earth and Space Science	3.ESS3.3	PS	obtain and combine information from various sources to describe patterns of Earth's features	ESS3.A	Obtaining, Evaluating, and Communicating Information	Systems and Systems	Adaptive

Formative Asmts By Topic

Scroll right to links to current resources



- NAVIGATION
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## "Student-Constructed Rubrics to Build toward MS-ESS1-4 Expectations"

**Resource or Activity Type**  
Static Prompt

**Timing or Sequence**  
Embedded

**Phenomenon Type**  
Anchoring Phenomenon—Geologic Intrusion

**Formative Activity Abstract**  
This type of formative strategy is best used as a check for understanding after the content has already been learned. By the end of Grade 8, this formative strategy will help students to have an understanding of the "analyses of rock strata and the fossil record" (A Framework for K-12 Science Education, p. 178). This activity helps students check in with their understanding of the identified learning goal (i.e., MS-ESS1-4) through deconstructing a typical constructed response summative item as a group. As a group, the teacher guides students to mastery of this concept by helping them recognize the levels of evidence needed for optimal comprehension. This activity also helps familiarize students with the concept of assessment through identifying features of performance and scoring.

**Standard Alignment**



**MS-ESS1-4** | Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6 billion-year-old history.

This formative strategy is well aligned to the content and practice with the opportunity to expand from constructing explanations into argumentation. This activity is not strongly aligned to the specific intersection of CCC 3 but it does strongly match the expectations for CCC 1.

**Best alignment to:** Middle School | ESS1.C | SEP 7 | CCC 1

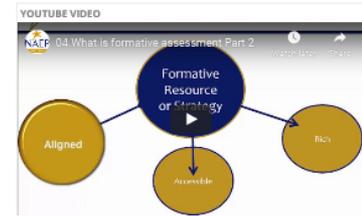
**Suggested Time for Activity**

If students are unfamiliar with rubrics and constructed response scoring, we encourage teachers to complete the **pre-activity** first. The **pre-activity** should take roughly 45 minutes to complete. We anticipate the actual "Student-Constructed Rubrics" activity will take approximately 60-70 minutes to complete.



See this formative strategy in action

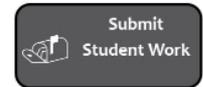
Using the rating scale (1-5), please rate this activity.



RATE THIS STRATEGY!  
The gadget spec URL could not be found

- 1 – Awful.
- 2 – Poor.
- 3 – Average.
- 4 – Good.
- 5 – Excellent.

Would you like to see sample student work?



Share your experience. In the comment section below, give your feedback, share some delivery tips or tricks, and/or any modifications you made to the strategy with your class.

Comments

You do not have permission to add comments.

# Science Resource Repository

## What's the Buzz? PDSA Cycle

**Montana Formative Science Resource**  
Contributed By: Monica Tomayer, Lily Haines, Melissa Johnson, and Ashley McGrath

**Activity Title**  
PDSA Cycle: *What's the Buzz in MS-LS1-4 and MS-LS2-2?*

## Student Constructed Rubrics MS-ESS1-4

**Montana Formative Science Resource**  
Contributed By: Ashley McGrath, Michelle McCarthy, and Katie Burke

**Activity Title**  
Student-Constructed Rubrics to Build toward MS-ESS1-4 Expectations

**Phenomenon Type**  
Anchoring Phenomenon—Geologic Intrusion

**Activity Abstract**  
This type of formative strategy is best used as a check for understanding after the content has already been learned. By the end of Grade 8, this formative strategy will help students to have an understanding of the “analyses of rock strata and the fossil record” (A Framework for K-12 Science Education, p. 178). This activity helps students check in with their understanding of the identified learning goal (i.e., MS-ESS1-4); as a group through deconstructing a typical constructed response summative item. The teacher guides students to mastery of this concept by helping them recognize the levels of evidence needed for optimal comprehension. This activity also helps familiarize students with the concept of assessment through identifying features of performance and scoring.



**Formative Strategy Vision**  
This activity will focus on acting on student-generated information to adjust instruction and student learning through the use of data-driven decision making that is guided by the cognitive evidence from student explanations using the claims-evidence-reasoning (CER) model. This activity is strategy-focused with its incorporation of the CER model to elicit explanations of the anchor phenomenon, and helps to group the varied facets of student reasoning to address learning gaps and support real-time instructional moves.

**Alignment**  
**MS-ESS1-4.** | Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6 billion-year-old history.  
This formative strategy is well aligned to the content and practice with the opportunity to expand constructing explanations into argumentation. This activity aligns with CCC 1 well, rather than the NGSS specified CCC 3.

Best alignment to: Middle School | ESS1.C | SEP 7 | CCC 1

## Iggy the Iguana: POE Strategy

**Montana Formative Science Resource**  
Contributed By: Monica Tomayer, Lily Haines, Melissa Johnson, and Ashley McGrath

**Activity Title**  
Collaborative POE Strategy using the *Iggy the Iguana* Online Simulation to Meet Multiple Middle School Life Science Performance Expectations

**Phenomenon Type**  
Investigative Phenomena

**Activity Abstract**  
This type of formative strategy is best used as a collaborative Predict-Observe-Explain (POE) strategy. At this grade-level, there is flexibility to use this activity to introduce concepts, use during the course of study, and to use after the concepts have already been learned. This strategy will help students by the end of Grade 8 to build their understanding and answer the driving question, “how do organisms interact in the physical environment to obtain matter and energy?” It will also help students with their understanding that ecosystems are dynamic in nature and disruptions to physical or biological components of an ecosystem can lead to shifts that can impact living organisms. These are important middle school concepts because ecosystems are ever changing due to the interdependence of organisms of the same or different species and the nonliving (physical) elements of the environment (A Framework for K-12 Science Education, 151–152). By having students collaboratively engage in the POE strategy, this activity will help them demonstrate their understanding with several middle school life science “Ecosystems: Interactions, Energy, and Dynamics” performance expectations as well as “Engineering Design” expectations and reinforce concepts from “Molecules to Organisms: Structures and Processes.” This activity is largely student-centered and touches on each aspect of the formative assessment process (i.e., clarifying intended learning, eliciting evidence, interpreting evidence, and acting on evidence).



**Formative Strategy Vision**  
This type of formative strategy is a collaborative POE strategy using a guided case study. There are many ways to implement this strategy with your students, but, with this one example, we suggest using the free, aligned, readily available, online NAEP Technology and Engineering (TEL) simulation with embedded life science content. With the addition of the simulation case study to the POE strategy, students are able to apply their knowledge to the design and ecosystem challenges that *Iggy the Iguana* faces. This suggested type of scenario and organism dynamic helps students solve real design problems and use their scientific reasoning to explain the phenomena while working collaboratively with their peers.

# Science Resource Repository

SCIENCE DOMAIN

PRACTICES

CROSSCUTTING CONCEPTS

INDIAN EDUCATION FOR ALL

SUBMIT A FORMATIVE RESOURCE

SUBMIT SAMPLE STUDENT WORK

**ACKNOWLEDGEMENTS**

CONTACT US



**Last Row:** Marshall Lagge, Bruce Dudek; **Sixth Row:** Amanda Obery, Emily Currier, Karla Miller, Jessica Ellertson, John Deming, Jared Betz; **Fifth Row:** Chris DeWald, Jennifer Stadum, Sue Mohr, Lilly Haines, Nicole Kirschten; **Fourth Row:** Ashley McGrath, Katie Burke, Melissa Johnson, Lindsay Manzo, Debbie Hanson; **Third Row:** Maureen Karlin, Jacqueline Marshall, Michelle McCarthy, Brian Williams; **Second Row:** Jodi Hall, Audrey Howard, Roni Sells, Monica Tomayer, Katherine Aune; **Front Row:** Karen Pollari, Marcy Fortner, Yvonne Field, Molly Ward, Mary Williams, Summer Graber.

# We are here to ASSIST!

## Putting Montana Students First

The Assessment Division aims to ensure the annual required statewide assessments are aligned to Montana's college-and career-ready academic standards, are equitable for all students, and provide meaningful results which can be used by various stakeholders to serve learning. We are committed to providing technical assistance to support test administration and in creating professional learning opportunities to increase assessment literacy across the state of Montana. **The MontCAS mission:**

- ◆ **Guide** administrators through the local role(s) and responsibility(ies) to administer required statewide assessments in compliance with federal and state law.
- ◆ **Support** teachers and administrators in developing tools and utilizing assessment data to improve instruction.
- ◆ **Mentor** test administrators on ensuring assessments are locally administered with fidelity and are accessible to all students.
- ◆ **Provide** high-quality technical assistance to support test administration and increase assessment literacy.
- ◆ **Offer** professional learning opportunities to empower educators to better utilize our balanced assessment systems.
- ◆ **Foster** partnerships in a collaborative environment with vested stakeholders.
- ◆ **Pursue** excellence in practice for evidence-based instruction and data-driven decisions.



*Actionable  
Systematic  
Supports to  
Inform  
Students and  
Teachers*



Educator Interests and  
Opportunities in  
Assessment



Use the QR Code (left) or link (below)  
<https://forms.gle/HFvZaYRHRT2YE16m8>  
to launch the form in your device.  
Questions? Contact the  
[OPIAssessmentHelpDesk@mt.gov](mailto:OPIAssessmentHelpDesk@mt.gov)



**MontCAS** Montana Comprehensive  
Assessment System  
Montana Office of Public Instruction



# Exit Slip

## PAO in Action (Process.Assessment.Outcome)

Formative Assessment Example – Exit Ticket which is a short quiz or a few simple questions and students give them to you as they leave your class.

(1.) What is formative assessment?

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(2.) Do you use it in your classroom?

- Yes
- No

(3.) If so, how do you use formative assessment?

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# Questions?



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Resource: [Montana's Initial Steps Toward Developing Formative Science Assessments](#)