



Earth Educators' Rendezvous 2019  
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# PERFORMANCE-BASED ASSESSMENTS: WHO, WHAT, AND WHY?!



Presented by

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# WHAT ARE WE GOING TO ACCOMPLISH TODAY?

## Goals

By the end of this workshop, participants will:

- Define what is meant by performance-based assessments
- Experience two different examples of performance-based assessments
- Describe the affordances and limitations of performance-based assessments.
- Consider how to align performance-based assessments with NGSS Crosscutting concepts or other course learning objectives.
- Generate a plan for enacting performance-based assessments in your classroom.

WHAT IS ONE ASSESSMENT STRATEGY YOU CURRENTLY USE AND A GOAL YOU HAVE WITH THAT ASSESSMENT OR ASSESSMENTS OVERALL?

- <https://tinyurl.com/collinsryker2019>

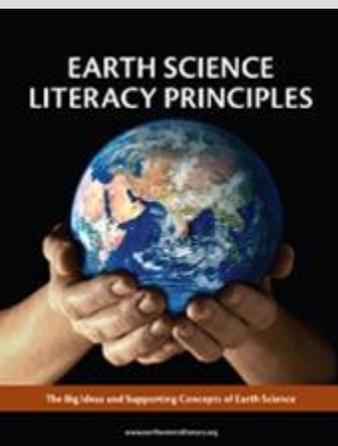
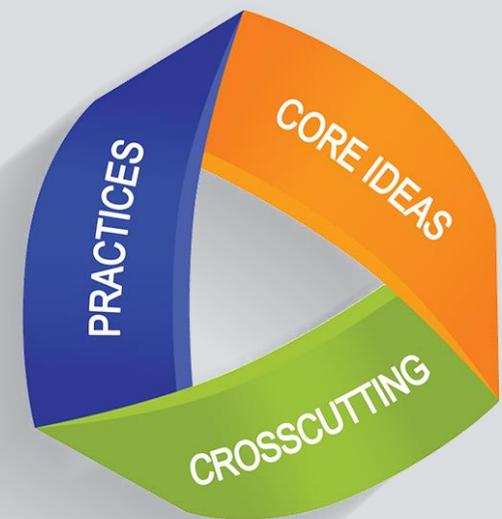
# TELL AND PRACTICE



How can our assessments promote active learning? One fruitful avenue is with...

## WHAT MAKES AN ASSESSMENT PERFORMANCE-BASED?

- Calls for an application of knowledge and skills, NOT just recall and recognition!
- Open-ended, do not require ONE specific answer!
- Provide new and authentic contexts for performance!
- Provide evidence of understanding via transfer
- Can be interdisciplinary and assess multiple standards



# EXAMPLES OF PERFORMANCE-BASED ASSESSMENT

- Writing
- Conducting research (I.e. Science Fair)
- Demonstration of laboratory procedure
- Interactive Historical Vignettes
- Building a model (can also be drawn or sketched)
- Sort Tasks

## Thinking Like a Chemist: Development of a Chemistry Card-Sorting Task To Probe Conceptual Expertise

Felicia E. Krieter,<sup>†</sup> Ryan W. Julius,<sup>†</sup> Kimberly D. Tanner,<sup>‡</sup> Seth D. Bush,<sup>†</sup> and Gregory E. Scott<sup>\*,†</sup>

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WILLIAM  
SMITH'S  
MAPPING MILESTONE

*An Interactive Historical Vignette celebrating  
the bicentennial of the first national geologic map*

Renee Clary

# SORT TASKS--CATEGORIZATION TASKS

- Foster Knowledge Transfer (near and far)
- Distinguish between expert and novice scientific understanding.
- Provide a scaffold/support for development and conceptual understanding
- Offer a forum that can reveal and providing feedback on student's developing ideas.



What are the modes of knowledge transfer?



*MUST BE BUILT AROUND A CONCEPT OR COURSE PRINCIPLE THAT REQUIRES DEEP, CONCEPTUAL UNDERSTANDING (I.E. NATURAL SELECTION).*

***Based on your understanding of the fundamental organization of superheroes, how would you approach sorting these superhero cards into groups?***



# How Do Superhero Novices Sort?

Robot  
Type

Iron Man



Cy



Warlock



Flying  
Type

Thor



m



Animal  
Type

Ant



Wolverine



Novices sort  
based on  
variations in  
appearance...

“SURFACE  
FEATURES”

*This is just one of likely many novice approaches...*

Adapted from  
Erika Offerdahl  
(College of  
Veterinary  
Medicine,  
Categorization  
workshop,  
2019).

# How Do Superhero Experts Sort?

The  
Avengers

Justice  
League

X-Men



Adapted from  
Erika Offerdahl  
(College of  
Veterinary  
Medicine,  
Categorization  
workshop,  
2019).

# How Do Superhero Experts Sort?

**Marvel  
Comics**

**DC  
Comics**

**Marvel  
Comics**



Adapted from Erika Offerdahl (College of Veterinary Medicine, Categorization workshop, 2019).

## LET'S TRY IT!

- Traits and Inheritance!
- Be prepared to share out your responses of what categories you identified and the reasoning that you generated!

# INVENTING THROUGH CONTRASTING CASES

- Contrasting cases help students notice deep structure through examining variation across contexts.
- Let's take a look at an example for 7<sup>th</sup> graders on traits and inheritance.

# AFFORDANCES AND LIMITATIONS

## **Affordances**

- Creative—thinking of ways to generate new ideas
- Diversity of opinions
- Generate a schema for categorizing cards (similar to I)
- Pattern identification
- Offers opportunity for scientific discourse (reach group level negotiation)
- Test the model—some categories don't fit?
- Equity in group—valuing everyone's background knowledge
- “Categorization to communicate”

## **Limitations**

- Organization of groups: novices only vs. novices and experts
- Feeling of wasted time – there was a “right” answer
- Caution: If you pose this as a divergent question, don't de-value answers (i.e. there really was one right answer).

# TRAITS AND INHERITANCE

Chipmunks survive the winter by storing food. Chipmunks with larger cheek pouches are able to store more food which helps them to survive winter. When the surviving chipmunks reproduce in spring, their babies will have larger cheek pouches. The chipmunk pouches will increase in size over generations.

Spider monkeys use their tails to hold onto branches as they look for food. Spider monkeys with longer tails are able to reach farther to find food. Spider monkeys that find food easily are more likely to reproduce. Their babies will also have longer tails. Eventually, the spider monkeys in this group will have very long tails.

- Feature-based=Primate vs. Non-Primate
- Relational Categories
  - Characteristic, survival, and inheritance are represented differently across cards.
- **How are they scored?**
  - **Edit Distance**

Water buffalos drink from rivers where crocodiles live. Young water buffalos are not cautious around water, but a few become cautious over time. Water buffalos that become cautious survive and reproduce, but their babies will not be cautious. All young water buffalos need to learn to be cautious around the river.

Chimpanzees are apes that can use sticks to catch termites in trees. As a chimp ages they are more likely to gain this skill. Those chimps that catch termites in this way will reproduce, yet their babies still need to develop this termite-catching skill.

# INTERCONCEPT ASSESSMENTS (MODEL-BUILDING)

- "All models are wrong, some are useful."—George E. P. Box
- In science, they help us describe and illustrate complex phenomena (with some limitations).
- Let's give this a try. Get help from a colleague(s) if you need it.

## HOW DO WE EVALUATE THESE FOR STUDENT LEARNING (AT INDIVIDUAL LEVEL)

- RISK ASSESSMENT
- Now that you have designed a model depicting the development of hotspot volcanoes, let's think back to 2018 and Kilauea. Imagine yourself as a news reporter, you must develop a full report (see our UDL framework) that depicts the following:
  - Explains what we we mean by risk and the geologic principles that cause the formation of hotspot volcanoes.
  - On a map of Hawaii, depict an eruption and illustrate on the map the areas that will be impacted by the eruption.
  - Describe and make recommendations to the citizens of Hawaii based upon the primary and secondary risks that you have identified!

# AFFORDANCES AND LIMITATIONS

## **Affordances**

- Gives creative types an opportunity to showcase their talents
- Multiple opportunities to express (and assess) your knowledge (drawing, writing)
- Connection to the community: makes this a more real exercise for students; not purely academic
- Changing frame to the news reporter
- Opportunity to showcase different geography: add a 20 second video showing eruption as a “hook”
- Semiotics: how to communicate with signs (arrows as indicators, movement); developing effective visualizations
- Gives students an opportunity to practice giving constructive feedback to others; communicating with peers; getting used to critiques as not a “bad” thing. Feedback as meaningful and actionable.
- Students get more comfortable accepting feedback, as well as giving it. Critiquing ideas, not people!
- ConceptSketches can be as complex or simple as the group wants to make it; not time or art skill-dependent. There are always things to add to a sketch; “we’re only done when we decide we’re done.”
- Professional, communication skills incorporated to match the course learning outcomes.
- Possibility to use this both as formative and summative assessment

## **Limitations/Barriers to Implementation**

- Sequencing: when to use this in class? Inappropriate at very beginning of lesson (insufficient background knowledge) and maybe at the end (regurgitation); might better fit in the middle of a unit.
- What to do with a lack of ability or comfort in communicating via sketch? Could break tasks up by strengths in the group. Feedback might help these students improve in this area.
- Grading challenge: determining what is the critical language or labels to include.
- Might just look up “the answer” via a device.
- Limited information in plate boundary sketch to guide news reporter
- Potential to reinforce a misconception about what is melting
- People who feel they’re already good at visuals (self-efficacy) don’t learn as much as those who have to struggle as much with the material, so both parts of the exercise are needed.

# FINAL THOUGHTS ON PERFORMANCE-BASED ASSESSMENTS

- Two perceptions illustrating how these PBAs are manipulable:
  - Sorting activity more open-ended, generative; model-building was more specific and maybe summative in nature.
  - Sorting activity more concrete; model-building could go on and on.
- Need to be careful about defining the lens we're using – be aware to avoid privileging forms of information
- The question of grading and activity vs. assessment. Need to define scope of material you're assessing, e.g. grade might be based on the risk assessment activity alone.
- AP rubrics from CollegeBoard – allow for variety in the answer while still assessing competency; multiple ways to get to 100%.
- Formative assessments can guide whether a re-teach is needed.
- Accept your limitations; everyone has different situations that influences how we assess – no one size fits all.

## SELECTED REFERENCES

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