



Assessing Explanation Tasks

Why Look at Student Work?

- Reflect and determine evidence and extent of student learning.
- Deepen our understanding of how students learn science.
- Reflect and assess intent and quality of the task.
- Analyze and clarify learning outcomes.
- Determine evidence and implications of effective teaching.
- Discuss and suggest teaching strategies.
- Inform our own learning needs as teachers.



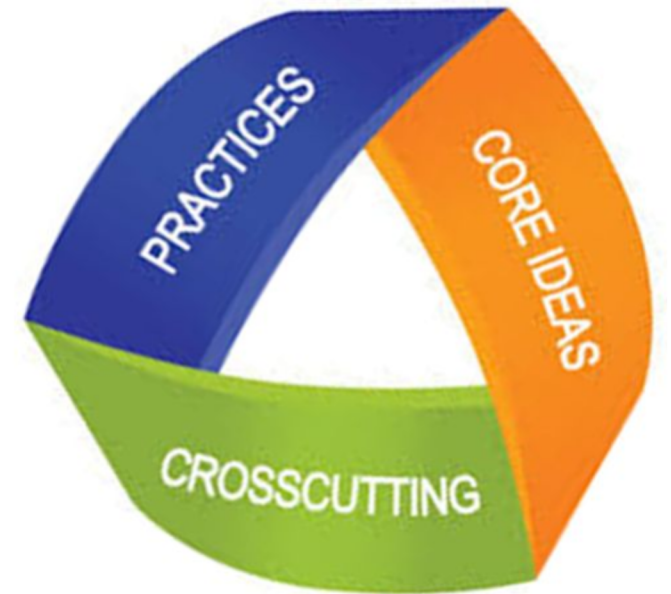
Let's Brainstorm about Assessment of the MEL activities...



In the Chat Box:

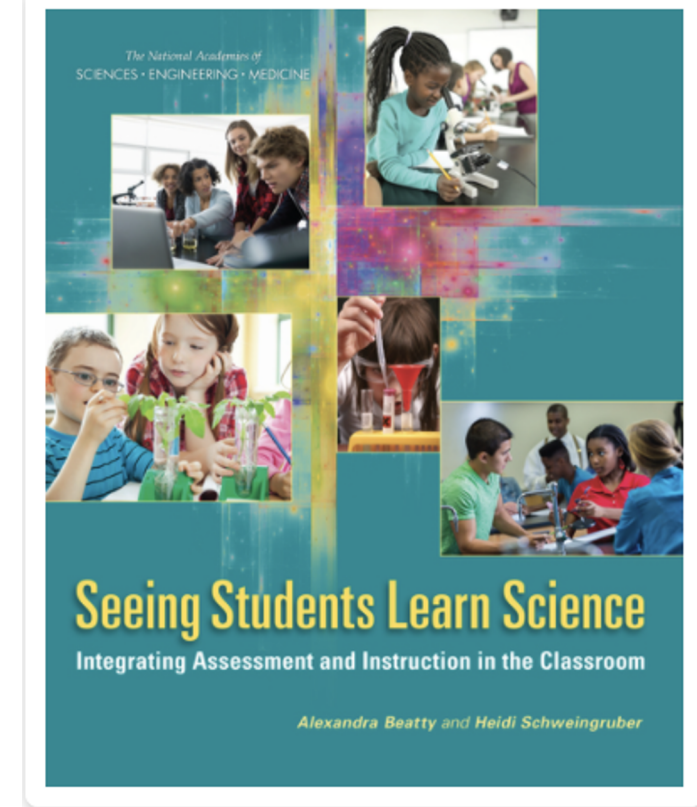
How would you assess the MEL diagram and/or explanation task to gauge whether students are learning?

Let's discuss.....

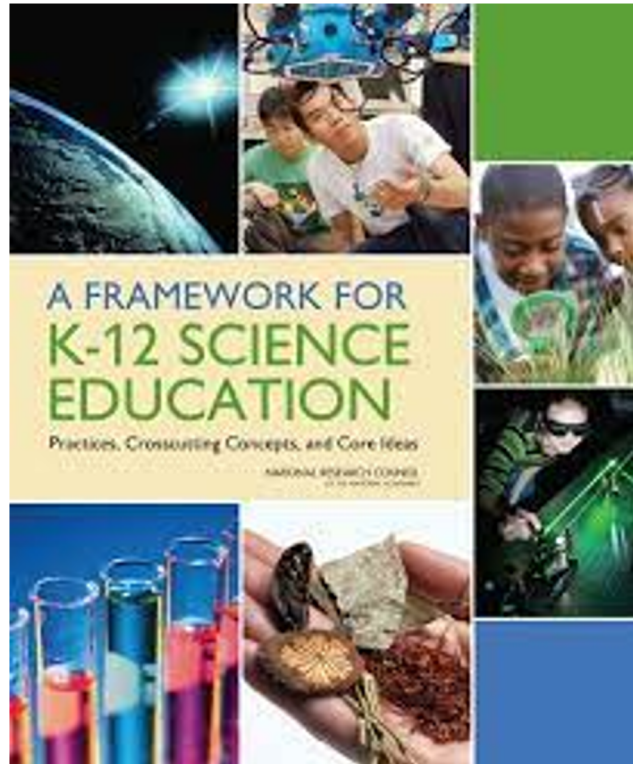


Characteristics of 3D Assessment

1. Should be varied to represent the breadth of all 3 dimensions.
2. Can include informal discussions, tasks, traditional quizzes, artifacts, computer simulations, projects.
3. Tasks that include multiple components to provide evidence of all three dimensions.
4. Attention to the connections between scientific concepts.
5. Line between instruction and assessment can be blurred as assessment is embedded in the learning experience.



Well-designed assessment can play a key role in students' science learning



Divergent Viewpoints....

Teacher 1

Assessments should cover all 3 dimensions, but *the most important aspect of student learning is their understanding of the DCIs* because they are ideas needed to explain the world around them.

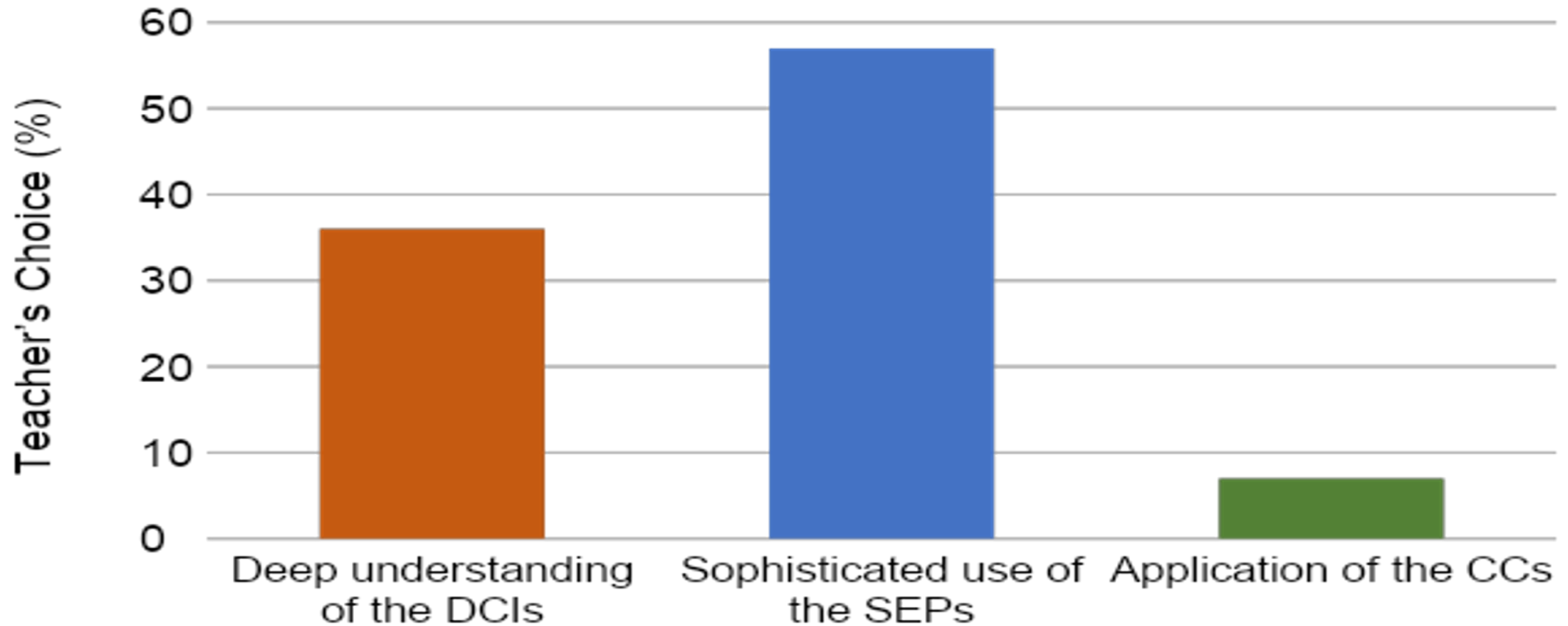
Teacher 2

Assessments should cover all 3 dimensions, but *the most important aspect of student learning is their understanding and ability to use the SEPs* because they are the ways students can explain the world around them.

Badrinarayan et al. (2019)

Which viewpoint is closer to yours? Why?

Recent research shows that most science teachers have the perspective that SEPs are the most important aspect



Badrinarayan et al. (2019)

We recommend only assessing the explanation task (not the diagram) and only in a formative assessment mode

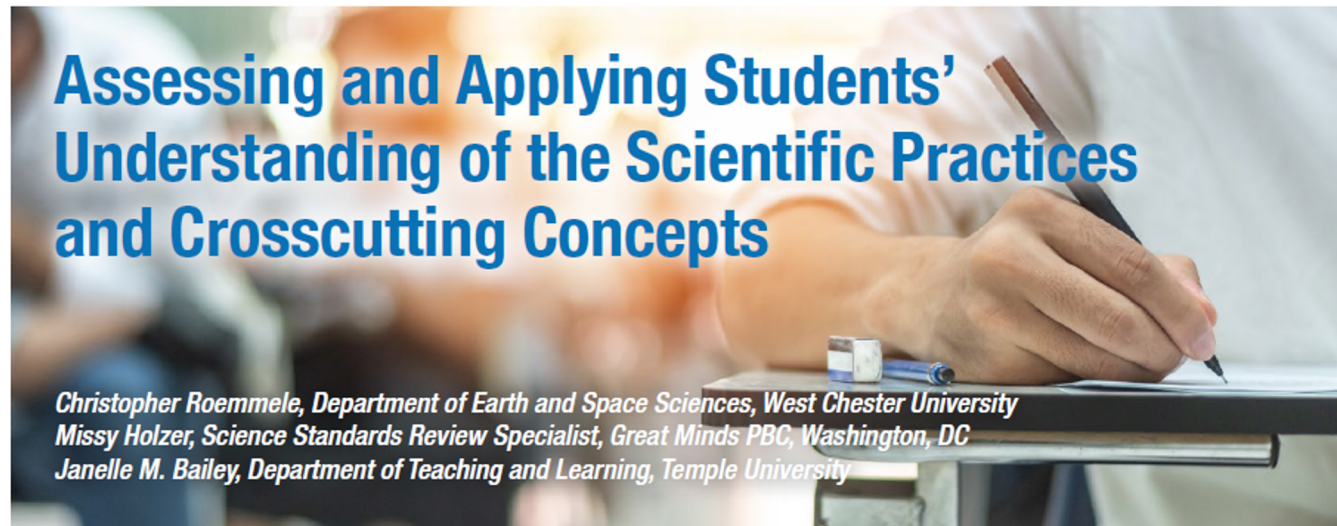
Evidence # 1 strongly supports | supports | contradicts | has nothing to do with Model A because:
It not only contradicts Model B, but this evidence provides direct answers or evidence to back up "sustain the biosphere" and in the benefits listed, "global cycles" support is critical to human welfare

The MELs grant students agency to take responsibility for their own learning

A MEL activity is one lesson in a unit of instruction to fully develop students' understanding of a few standards

Assessing Student Work

- Take a few minutes to read & discuss the article (pgs 27-28) on assessing MELs
- What is evaluated?
Why?
- Important points?



Assessing MEL Student Work Samples

1. Start by identifying the goal of the MEL - what was the goal of the Moon MEL?

2. How would you know if students met this goal?

3. What product would you evaluate? How? Why?

a. Diagrams?

b. Rating?

c. Explanations?



If you worked with other students, their name(s): _____

Directions: Draw 2 arrows from each evidence box, one to each model. You will draw a total of 8 arrows.

Key:

- The evidence supports the model
- The evidence **STRONGLY** supports the model
- The evidence **contradicts** the model (shows it's wrong)
- The evidence has nothing to do with the model

Evidence #1 Atmospheric concentration past 50 years led to great gases. Temp rising during

Evidence #2 Solar activity 1970. Less has received but, Earth's continued to

Evidence #3

Please work on this individually.

Provide a reason for three of the arrows you have drawn. Write your reasons for the three most interesting or important arrows.

- Write the number of the evidence you are writing about.
- Circle the appropriate word (strongly supports | supports | contradicts | has nothing to do with).
- Write which model you are writing about.
- Then write your reason.

1. Evidence # 1 strongly supports | supports | contradicts | has nothing to do with Model A because:
It mentions how atmospheric greenhouse gas concentrations have been going up for the past 50 years. Model A is about our climate changing because of gases released.

2. Evidence # 2 strongly supports | supports | contradicts | has nothing to do with Model B because:
It Evidence #2, It says solar activity has decreased since 1970. In Model B, it states that our climate changed because of the amounts of energy received from the sun. Both state about the energy of the sun.

3. Evidence # 3 strongly supports | supports | contradicts | has nothing to do with Model A because:
Evidence #3 talks about satellites measuring the earth's energy being absorbed by G.H gases. The opposite of what Model A states. Model A talks about our climate changing because of gases released.

Circle the plausibility of each model. [Make two circles, one for each model.]

	1	2	3	4	5	6	7	8	9	10
Model A	1	2	3	4	5	6	7	8	9	10
Model B	1	2	3	4	5	6	7	8	9	10

Assessing Student Explanatory Task

- Assessing proficiency in SEPs and CCs
 - SEPs: Developing and Using Models, Analyzing and Interpreting Data, Constructing Explanations, Engaging in Argument from Evidence
 - CCs: Cause and Effect, Stability and Change
- Types of responses in the rubric:
 - Mastering
 - Approaching
 - Developing
 - Beginning
- How would you describe each? What would each “look” like in a student work sample?



The MEL2 Team has developed a rubric that focuses on four SEPs (scientific & engineering practices) and two CCs (crosscutting concepts)

MEL Explanation Task Rubrics

Science and Engineering Practices Rubric				
Science & Engineering Practice	Mastery	Approaching	Developing	Beginning
<i>Developing and Using Models</i>	The explanation clearly and accurately evaluates the merits and limitations of the two different models of the phenomenon in order to select the most plausible model based on the evidence.	The explanation evaluates the merits and limitations of one of the two different models of the phenomenon in order to select the most plausible model based on the evidence.	The explanation has little or no evaluation of the merits or limitations of one of the two different models of the phenomenon in order to select the most plausible model based on the evidence.	The explanation does not evaluate the merits or limitations of either model, or the explanation is erroneous, in order to select the most plausible model based on the evidence.
<i>Engaging in Argument from Evidence</i>	The student's written explanation accurately and precisely identifies the strength or weakness of the evidence to model link based on comparing and integrating how evidence supports or contradicts a particular model using several lines of data from the multiple evidence texts.	The student's written explanation accurately identifies the strength or weakness of the evidence to model link, but the student's analysis may not be well integrated and/or may be missing comparisons to another model, with only a moderate level of justification using the data from the evidence texts.	The student's written explanation has some inaccurate information in identifying the strength or weakness of the evidence to model link, with little integration of the data from evidence texts or weakly justifying their reasoning with evidence from the texts or incorrectly applying one of the evidence pieces.	The student's written explanation conveys inaccurate information or does not identify the strength or weakness of the evidence to model link with no integration of the data from evidence texts or justification with evidence or incorrect lines of evidence.

This is an analytical rubric, gauging:

1. Levels of performance
2. Criteria (i.e., the SEPs)
3. Detailed descriptors

Please take a look at the rubric...

What do you notice?

Would you use all four SEPs when assessing student work? Would you use only one SEP? Or some other combination?

What Does it Look Like?

Beginning

- *"Ev. #1 is stating that a lot of increases in temp. are being"*
- *"Fracking fluids and wastewater can be the cause of normal tectonic"*
- *"Show increase and decrease since Industrial Revolution."*

Statements are incomplete, erroneous, don't make sense, unrelated or wrong.

Developing

- *"Talks about how human activity affects Earth"*
- *"E3 has nothing to do with MA because it doesn't talk about fracking at all and just totally goes to natural causes."*
- *"they talk about two different things."*

Statements are correct but superficial, restate the obvious but no elaboration.

What Does it Look Like?

Approaching

- *"The evidence talks about how the sun's energy is decreasing, but model B is stating how the Sun's energy is increasing"*
- *"In Model A its talking about fracking causing earthquakes and evidence #1 said that fracking causes stress on the crust."*
- *"Because the climate is currently changing due to the sun and the energy released"*

Statements provide correlation between model and evidence, provide additional elaboration

Mastery

- *"Most earthquakes occurs near a fracking site which may tell us that fracking causes earthquakes." "E3 has nothing to do with MA because it doesn't talk about fracking at all and just totally goes to natural causes."*
- *"If the increase in greenhouse gases which keep Earth's energy from escaping to space is caused by humans then it is human's responsibility the climate increase."*

Statements elaborate on relationship between model and evidence with clear or implied, cause-and-effect relationship

Norms for Looking at Student Work

Please...

1. Be in the spirit of dialogue
2. Try to focus on what the students' actually write (i.e., what you observe)
3. Try not to focus on what you might infer from the students' writing
4. Try not to focus on what you think the students should know or be able to do
5. Be aware of your biases

Classroom Rules

**Be ready to
dream big**
**be kind to
everyone**
raise your hand
**say please
and
thank you**
do your best
use your imagination
**listen to
your teacher**

Let's Do One Together....

Find the last sample in the
Google Classroom file....
The second Wetlands exemplar

Please work on this part individually after you complete your diagram. Now that you have completed the diagram, reconsider the plausibility of Models A and B.

Circle the plausibility of each model. [Make two circles, one for each model.]

	Greatly implausible or even impossible									Highly Plausible
Model A	1	2	3	4	5	6	7	8	9	10
Model B	1	2	3	4	5	6	7	8	9	10

Did the plausibility of Model A and/or Model B change after you completed the diagram? Yes or No [Circle One]

[Note: you may have to look at your previous ratings if you do not remember what they were. Ask your teacher for assistance.]

Which arrows changed your plausibility judgments about the models? If your plausibility judgment did not change, which arrows supported your original plausibility judgments? Use the following steps to provide two explanations for why your plausibility judgments did or did not change.

- Write the number of the evidence you are writing about. [Note: it is okay to include more than one evidence]
- Circle the appropriate word (**strongly supports** | **supports** | **contradicts** | **has nothing to do with**).
- Write which model you are writing about. [Note it is okay to include both models].
- Then write your reason.

1. Evidence # 1 **strongly supports** | supports | contradicts | has nothing to do with Model A because:

Evidence 1 states that wetlands are important in global cycles and help humans through these cycles.

2. Evidence # 2 **strongly supports** | supports | contradicts | has nothing to do with Model A because:

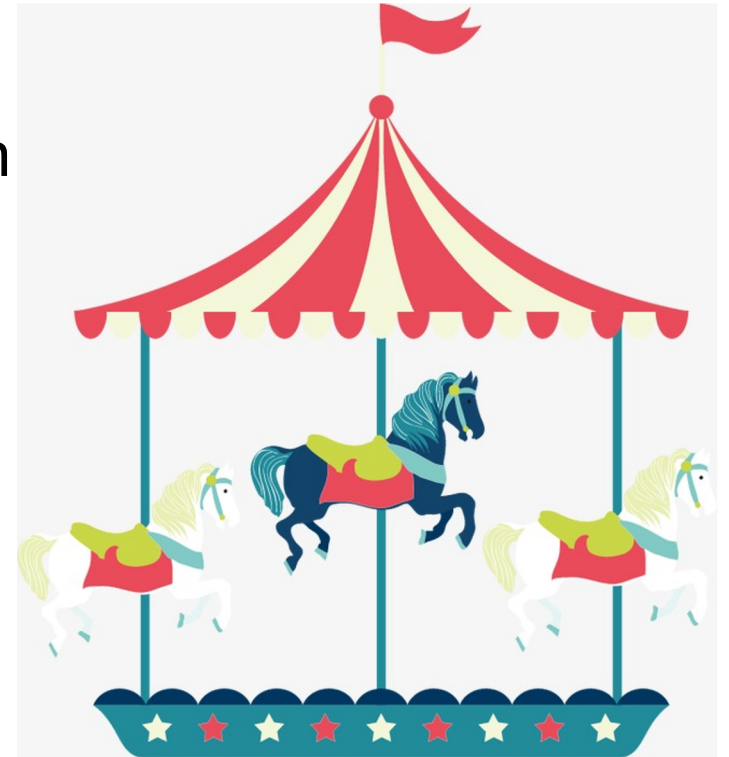
Evidence 2 states that wetlands collect floodwater, therefore saving people from the damages of floods.

MEL/baMEL	SEPs	CCCs
Climate Change	Engaging in Argument from Evidence Constructing Explanations Analyzing and Interpreting Data	Cause & Effect
Moon Formation	Developing and Using Models Engaging in Argument from Evidence Constructing Explanations	Cause & Effect
Fracking	Engaging in Argument from Evidence Constructing Explanations Analyzing and Interpreting Data	Stability & Change
Wetlands	Constructing Explanations Engaging in Argument from Evidence Constructing Explanations	Stability & Change
Freshwater Resources	Engaging in Argument from Evidence Constructing Explanations Analyzing and Interpreting Data	Cause & Effect
Extreme Weather	Engaging in Argument from Evidence Constructing Explanations Analyzing and Interpreting Data	Cause & Effect
Fossils	Engaging in Argument from Evidence Constructing Explanations	Stability & Change
Origins of the Universe	Engaging in Argument from Evidence Constructing Explanations	Stability & Change

Activity: Assessing Student Samples

Working in your Breakout Groups:

- Assess the additional samples of student responses, and identify the types of responses in each.
- Discuss your findings –identify the evidence supporting your evaluation!
- Be prepared to support your claims!



Activity: Assessing Student Samples

Whole Group discussion:

- Which rows [SEPs] of the rubric were easier to use? Which [SEPs] rows were more challenging to use? Why?
- What other things did you notice? What other thoughts about assessment do you have?

Keeping in mind student learning:

- At what level do we want students to support their claims?
- How do we move them?
- How do we GRADE them?



*How do we move students from
Beginning to Developing to Approaching
to Mastery?*

Let's take a short break...
See you in 15 minutes!

