Engaging Students in Scientific Practices:
Evaluating Evidence and Explanation in Secondary Earth and Space Science
Day 2: Analyzing Student Work Samples

Why Look at Student Work?

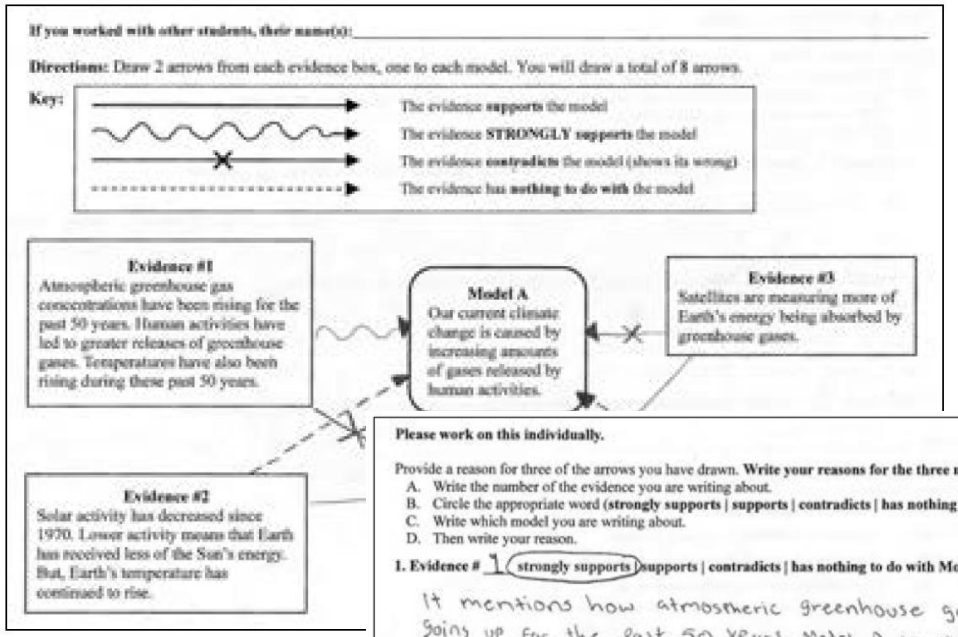
- Reflect and determine evidence and extent of student learning.
- Deepen our understanding of how students learn science
- Reflect and assess intent and quality of the task.
- Analyze and clarify learning outcomes.
- Determine evidence and implications of effective teaching.
- Discuss and suggest teaching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

Ground Rules for Looking at Student Work

- Be in the spirit of dialogue.
- Focus on the evidence, not what you *think* the student knows or can do.
- Be aware of personal biases.
- Separate observations from inferences.
- Put your stake in the ground *AND* be ready to move it.

Assessing MEL Student Work Samples

- Start by identifying the goal of the MEL
- How would you know if students met this goal?
- What product would you evaluate? How? Why?
  - Diagrams?
  - Rating?
  - 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:

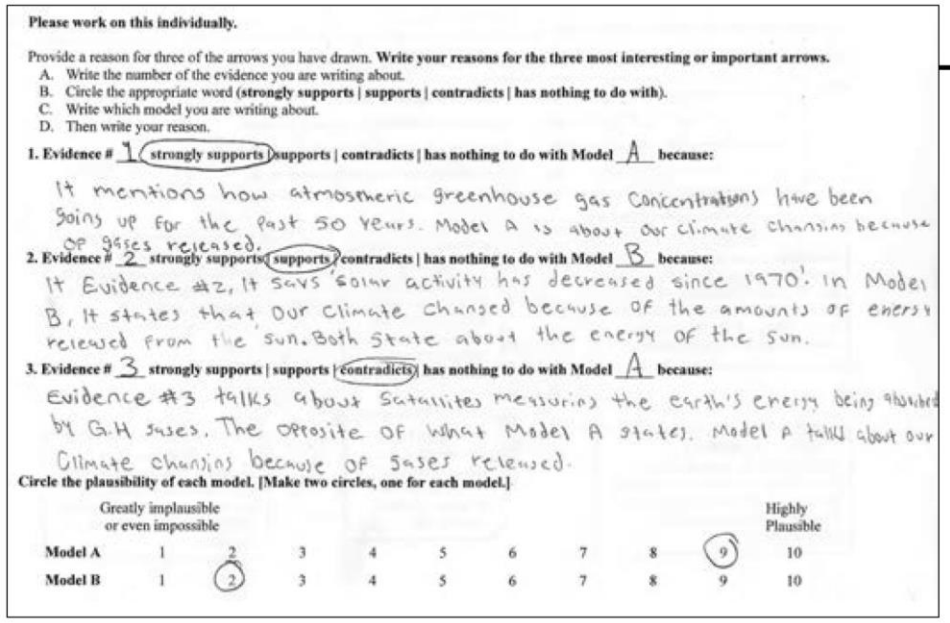
- The evidence **supports** the model
- The evidence **STRONGLY supports** the model
- The evidence **contradicts** the model (shows its wrong)
- The evidence has **nothing to do with** the model

Evidence #1
Atmospheric greenhouse gas concentrations have been rising for the past 50 years. Human activities have led to greater releases of greenhouse gases. Temperatures have also been rising during these past 50 years.

Model A
Our current climate change is caused by increasing amounts of gases released by human activities.

Evidence #3
Satellites are measuring more of Earth's energy being absorbed by greenhouse gases.

Evidence #2
Solar activity has decreased since 1970. Lower activity means that Earth has received less of the Sun's energy. But, Earth's temperature has continued to rise.



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.**

A. Write the number of the evidence you are writing about.
B. Circle the appropriate word (**strongly supports | supports | contradicts | has nothing to do with**).
C. Write which model you are writing about.
D. 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:**

In 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 released 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:**

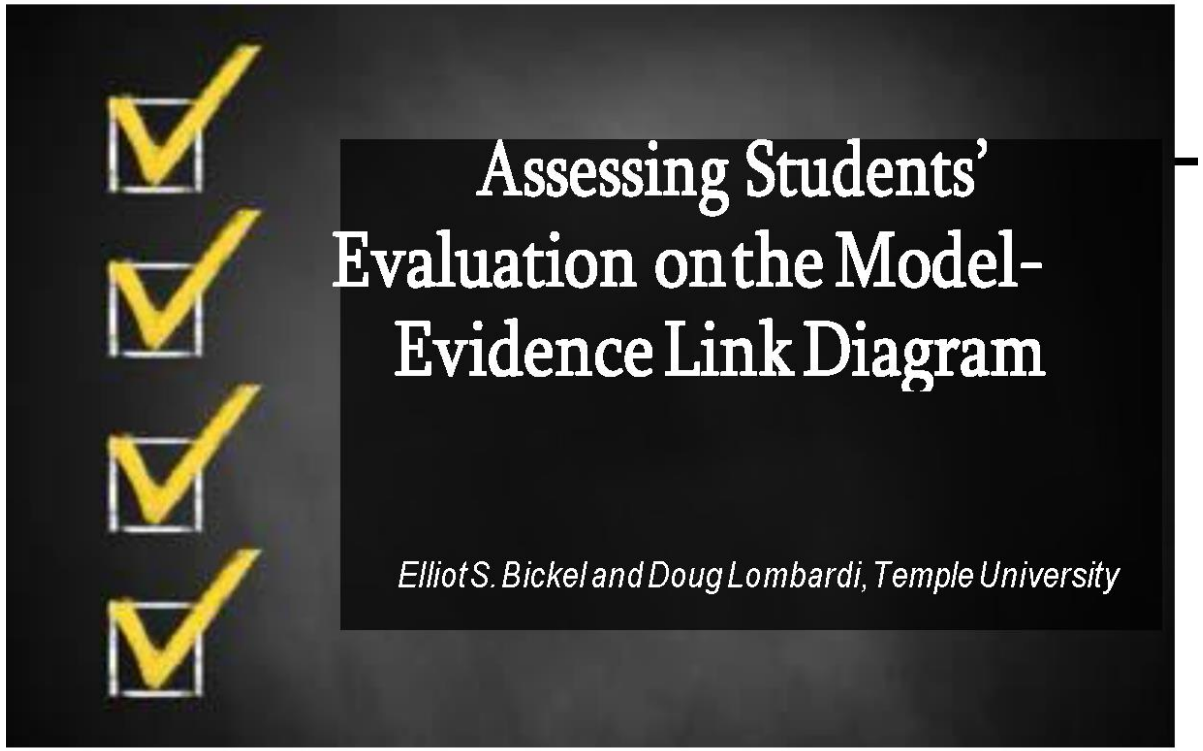
Evidence #3 talks about satellites measuring the earth's energy being absorbed by G.H gases. The opposite of what Model A states. Model A talks about our climate changing because of gases released.

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

	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

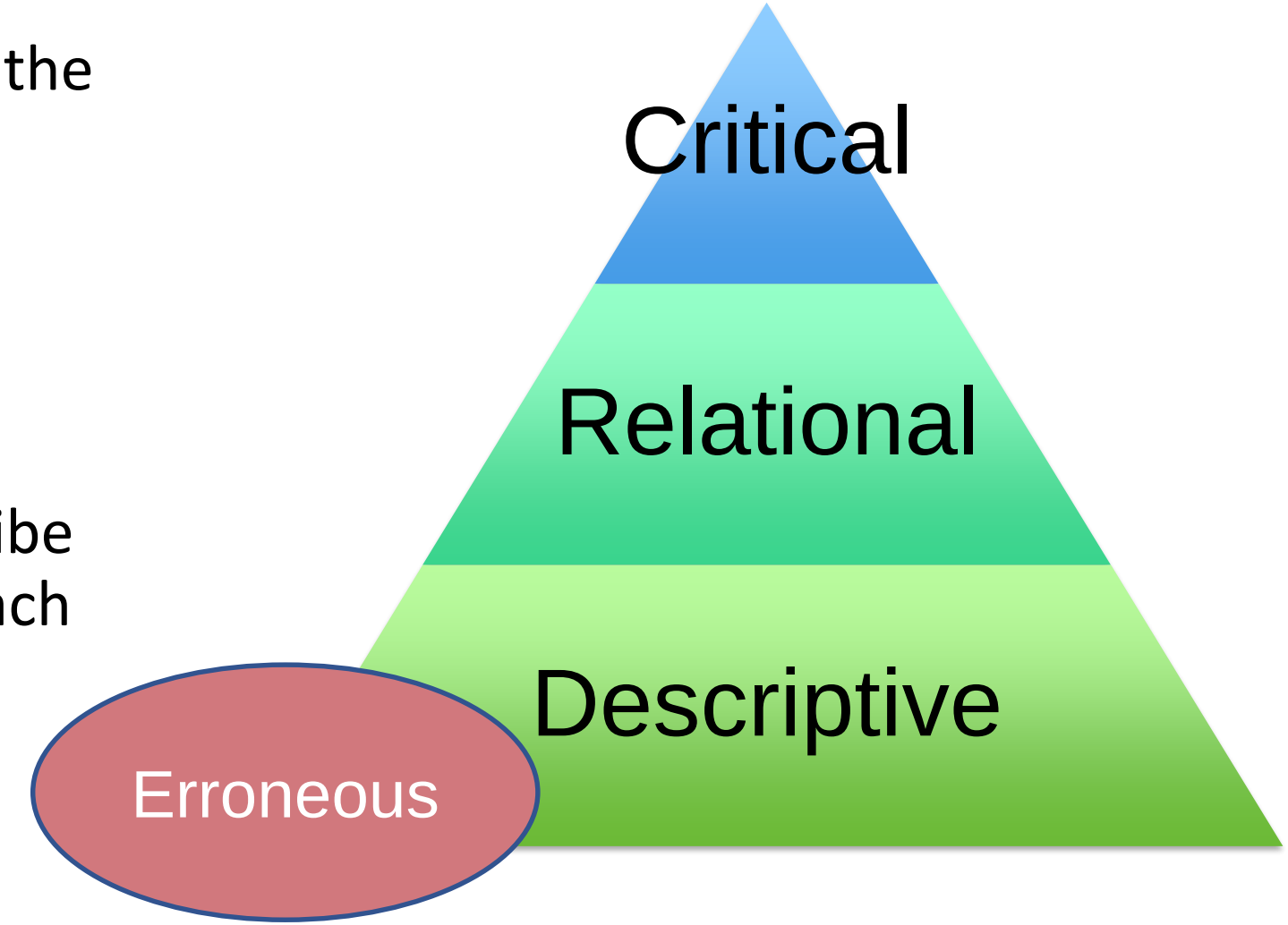
Assessing Student Work

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



Assessing Student Explanatory Task

- Types of responses in the rubric:
  - Erroneous
  - Descriptive
  - Relational
  - Critical
- How would you describe each? What would each "look" like?



What Does it Look Like?

Erroneous

- *"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.

Descriptive

- *"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?

Relational

- *"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

Critical Evaluation

- *"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

Break!

Be back in 15 minutes

Let's Do One Together….

Find the last sample in your handout packet….
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.

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

Wetlands MEL Explanation Task (11/30/2014) *Page 1 of 1*

Many responses (other than erroneous ones), are not always clear. They often fall on a continuum. Classify responses where they best fit!

Descriptive to ***Relational***

R tional *to Critical Evaluation*

Activity: Assessing Student Samples

Working with a partner:

- Assess the additional samples of student responses, and identify the types of responses in each.
- Discuss your findings –identify the evidence supporting your evaluation!
- Carousel: Place your types for each evidence sample on a post-it (total of 14). Move around the room and place them the appropriate chart paper by MEL *(only do the first 2 for Climate & Moon)*
- Be prepared to support your claims!

Activity: Assessing Student Samples

Whole Group discussion:

- Re-rate your Wetland response - did it change?
- Were some types of responses more prevalent than others? If so, why?
- 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 "Descriptive" to "Relational" to "Critical?"

Lunch - See you in 45 minutes!

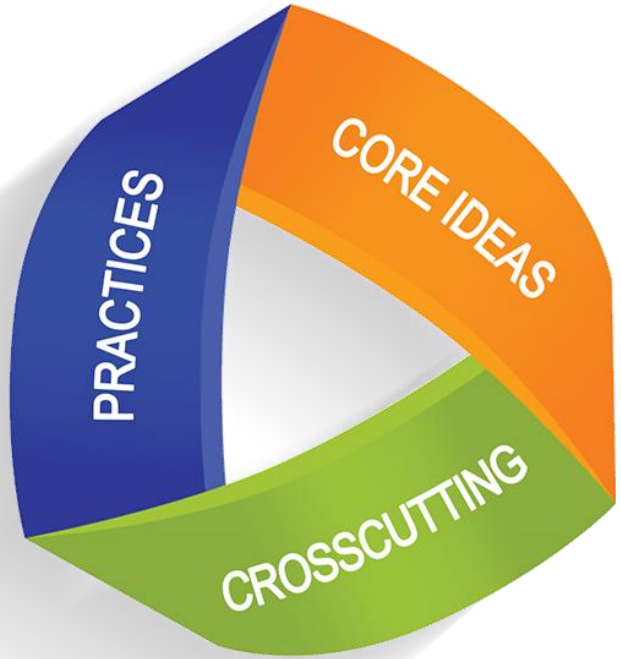
Engaging Students in Scientific Practices:
Evaluating Evidence and Explanation in Secondary Earth and Space Science
Day 2: EQuIP Lesson Screener

3-D Lesson Evaluation

Achieve/NSTA Lesson Screener (NGSS/GSES)

Purpose to determine:

- if a lesson is on the right track for 3-D instruction
- if a lesson warrants a more extensive review (using the EQuIP Rubric)
- common understanding by reviewers of the GSES/NGSS
- elicit conversations among educators while evaluating materials
- offer feedback and suggestions to improve lessons
- Provides an overview – not a thorough examination



Evaluation Criteria

NGSS Shifts

A. **Explaining Phenomena or Designing Solutions**: The lesson focuses on supporting students to make sense of a phenomenon or design solutions to a problem.

B. **Three Dimensions**: The lesson helps students develop and use multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs), which are deliberately selected to aid student sense-making of phenomena or designing of solutions.

C. **Integrating the Three Dimensions for Instruction and Assessment:** The lesson requires student performances that integrate elements of the SEPs, CCCs, and DCIs to make sense of phenomena or design solutions to problems, and the lesson elicits student artifacts that show direct, observable evidence of three-dimensional learning.

atures of Quality Design

D. **Relevance and Authenticity:** The lesson motivates student sense-making or problem-solving by taking advantage of student questions and prior experiences in the context of the students' home, neighborhood, and community as appropriate.

E. **Student Ideas:** The lesson provides opportunities for students to r ideas (i.e., making thinking visible) and to respond to peer and teacher feedb

F. **Building on Students' Prior Knowledge**: The lesson identifies and sions in a way that is explicit to both the teacher and the students.

Our Focus

THE MEL PROJECT

3-D Lesson Evaluation Process

LOOK FOR: What is in the lesson materials, where is it and why is this evidence!

- individually record criterion-baseevidence
- individually make suggestions for improvement
- collaboratively discuss findings with team
- check one of the boxes under the "Evidence of Quality" column.

Working as a group will not only result in a better lesson, but can also bring the group to a common and deeper understanding of designing lessons for the NGSS.

NOTE: "Adequate" means that the lesson meets the criterion.

Criterion B. Three Dimensions

	NGSS designed lessons will look *less* like this:	NGSS designed lessons will look *more* like this:
Three Dimensions	A single practice element shows up in the lesson.	The lesson helps students use multiple (e.g., 2–4) practice elements as appropriate in their learning.
	The lesson focuses on colloquial definitions of the practice or crosscutting concept names (e.g., "asking questions", "cause and effect") rather than on grade-appropriate learning goals (e.g., elements in NGSS Appendices F &G).	Specific grade-appropriate elements of SEPs and CCCs (from NGSS Appendices F & G) are acquired, improved, or used by students to help explain phenomena or solve problems during the lesson.
	The SEPs and CCCs can be inferred by the teacher (not necessarily the students) from the lesson materials.	Students explicitly use the SEP and CCC elements to make sense of the phenomenon or to solve a problem.
	Engineering lessons focus on trial and error activities that don't require science or engineering knowledge.	Engineering lessons require students to acquire and use elements of DCIs from physical, life, or Earth and space sciences together with elements of DCIs from engineering design (ETS) to solve design problems.

Look at the materials for the Wetland MEL and complete the screener for Criterion B

THE MEL PROJECT

Group Share: What evidence is in the MEL?

2. **Record specifically where you find each dimension** in the lesson. Describe in the response form below how this evidence is or is not an adequate indicator the criterion is being met. Include detailed suggestions for improvement.

Lessons designed for the NGSS include clear and compelling evidence of the following:	What was in the materials, where was it, and why is this evidence?		Overall Evidence of Quality?	Suggestions for improvement
B. Three Dimensions: The lesson helps students develop and use multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) which are deliberately selected to aid student sense-making of phenomena or designing of solutions.	Document evidence for each dimension.	**Evidence?**	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	
	SEP	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive		
	DCI	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive		
	CCC	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive		

3. If you are working in a group, **compare lists of evidence and reasoning and come to consensus** about whether this lesson met Criterion B.

Criterion C. Integrating the Three Dimensions for Instruction and Assessment

	NGSS designed lessons will look *less* like this:	NGSS designed lessons will look *more* like this:
Integrating the Three Dimensions	Students learn the three dimensions in isolation from each other (e.g., a separate lesson or activity on science methods followed by a later lesson on science knowledge).	• The lesson is designed to build student proficiency in at least one grade-appropriate element from each of the three dimensions. • The three dimensions intentionally work together to help students explain a phenomenon or design solutions to a problem. • All three dimensions are necessary for sense-making and problem-solving.
	Teachers assume that correct answers indicate student proficiency without the student providing evidence or reasoning.	Teachers deliberately seek out student artifacts that show direct, observable evidence of learning, building toward all three dimensions of the NGSS at a grade-appropriate level.
	Teachers measure only one dimension at a time (e.g., separate items for measuring SEPs, DCIs, and CCCs).	Teachers use tasks that ask students to explain phenomena or design solutions to problems, and that reveal the level of student proficiency in all three dimensions.

Look at the materials for the Wetland MEL and complete the screener for Criterion C

THE MEL PROJECT

Group Share: What evidence is in the MEL?

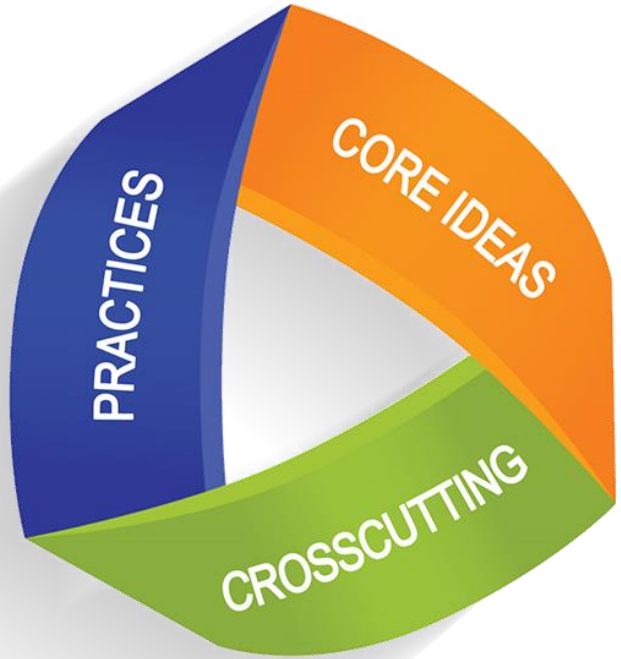
2. **Record evidence** about how the three dimensions are integrated for instruction and assessment purposes. Describe in the response form below how this evidence is or is not an adequate indicator the criterion is being met. Include detailed suggestions for improvement.

Lessons designed for the NGSS include clear and compelling evidence of the following:	What was in the materials, where was it, and why is this evidence?	Evidence of Quality?	Suggestions for improvement
C. Integrating the Three Dimensions for Instruction and Assessment: The lesson requires student performances that integrate elements of the SEPs, CCCs, and DCIs to make sense of phenomena or design solutions to problems, and the lesson elicits student artifacts that show direct, observable evidence of three-dimensional learning.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	

3. If you are working in a group, **compare lists of evidence and reasoning and come to consensus** about whether this lesson met Criterion C.

3-D Lesson Screener - How did we do?

- How well does the Wetlands MEL meet the rigorous criteria for 3D teaching and learning according to the lesson screener?
  - Strengths and weaknesses?
- Did the discussions help develop a deeper understanding of 3D teaching and learning?
- How would you use a MEL in your 3-D teaching and learning setting?



Thank you!