

Activity Before Concept:

How can we use Inquiry Strategies to foster deep Engagement over simple Compliance?

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Your Mission:

From any place on Earth a person can see more eclipses of the Moon than of the Sun. Why do you think this is so? Put an X in front of all of the statements that support reasons why we see more lunar eclipses than solar eclipses.



- A. The Sun moves more quickly than the Moon.
- B. Anyone who can see the Moon when it enters Earth's shadow will see an eclipse of the Moon.
- C. The shadow of the Moon on the Earth is very small and moves quickly.
- D. The Moon goes in front of the Sun more often than the Sun goes in front of the Moon.
- E. The Moon's orbit around the Earth is faster than the Earth's orbit around the Sun.
- F. The Moon spins on its axis faster than the Earth spins on its axis.

On your Whiteboard:

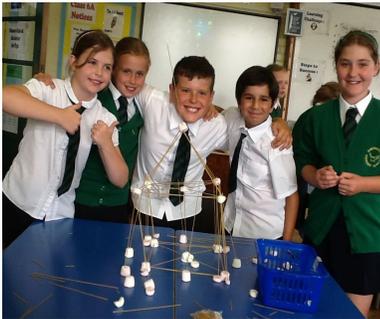
- Describe your thinking. Use the ideas you marked with an X to explain why we see more lunar eclipses than solar eclipses.
- Create diagrams, use models to help showcase your ideas.



“Traditional” Lesson Flow



“ABC” = Activity Before Concept!



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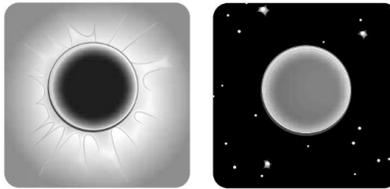


Designing and using activities where students learn new concepts by actively doing and reflecting on what they have done. **The guiding principle is that instructors try not to talk in depth about a concept until students have had an opportunity to think about it first** (Hastings, 2006).

Lesson Flow:

- 1) Inquiry Activity
&
- 2) Class/Team Discussion

Comparing Eclipses



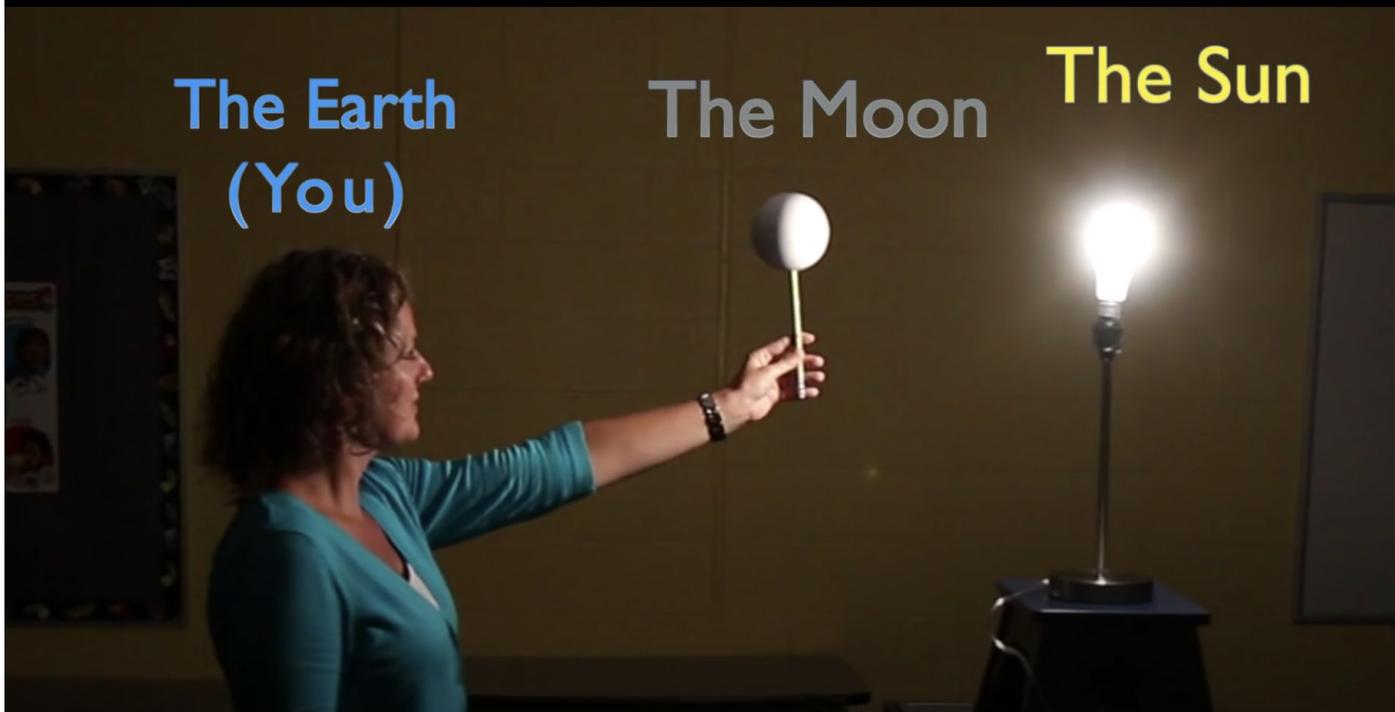
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Lesson Flow:

- 3) Class demonstration/Lecture/Notes





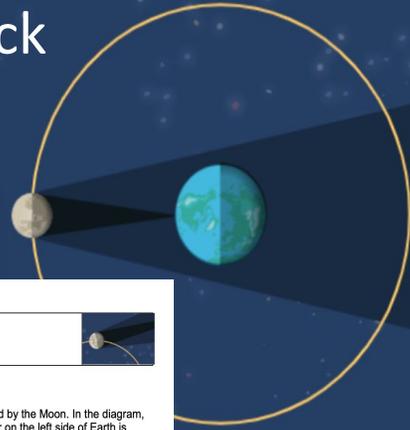
Tools



Show ray trace



Lesson Flow: 4) Individual Practice/Feedback



Views: Earth shadow

Moon diameter:

Earth diameter:

Sun diameter:

Earth-Moon distance:

Diagram not to scale.

Activity A: Solar eclipse
Get the Gizmo ready:
• Select **Moon shadow**.



Question: What causes a solar eclipse?

1. **Predict:** During a solar eclipse, our view of the Sun is blocked by the Moon. In the diagram, draw where you think the Moon is located when the observer on the left side of Earth is experiencing a solar eclipse.



2. **Observe:** Move the Moon slowly around Earth in a counterclockwise direction. As you do this, pay attention to the Moon's shadow and the **Sun view** in the upper right corner.

What do you notice? _____

3. **Record:** Position the Moon so that the Sun is completely blocked. Draw the Moon, the Moon's umbra, and the Moon's penumbra in the image below. This is a **total solar eclipse**.



4. **Record:** Position the Moon so that the Sun is partially blocked. Draw the Moon, the Moon's umbra, and the Moon's penumbra in the image below. This is a **partial solar eclipse**.



Moon view



Sun view

Lesson Flow: 5) Authentic Assessment/ Performance Task

Modeling the Moon

Does the Earth Go Through Phases?



Four students were working together on a science fiction story. Their story took place on the Moon. One of the students wrote a scene in which two of the characters were looking up at the "crescent Earth" just as it was setting just behind a mountain on the Moon. The students had different ideas about the scene. This is what they said:

Brett: "I don't think you would see phases of the Earth. The Earth always looks like a round blue ball from space. But I do think you would see the Earth set."

Margot: "I think we would see a 'crescent Earth.' It's just like being on Earth and looking up at the Moon. But the Earth would never 'set.'"

Scarlet: "I agree that we would see a 'crescent Earth.' The 'crescent Earth' would set, but it would set very slowly."

Hermione: "I don't think you would ever see a 'crescent Earth' or ever see the Earth rise or set."

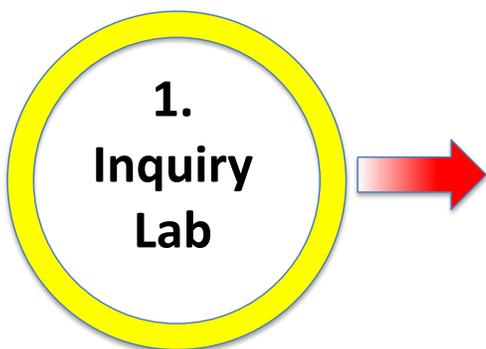
Who do you think has the best idea about "Earth phases" and a rising and setting Earth? _____ Explain why you think that is the best idea.

1. Inquiry Activity:

*No directions are given for how to solve the problem. Focuses just as much on the **act** of problem solving vs. the outcome.

*As in the real world, creative problem solving and using a variety of methods is encouraged!

***Zone of Proximal Development (ZPD):** Carrot has to be in the exact right spot- not too easy, not too difficult. (Guiding vs probing questions, scaffolding, however- ZPD is most important.)

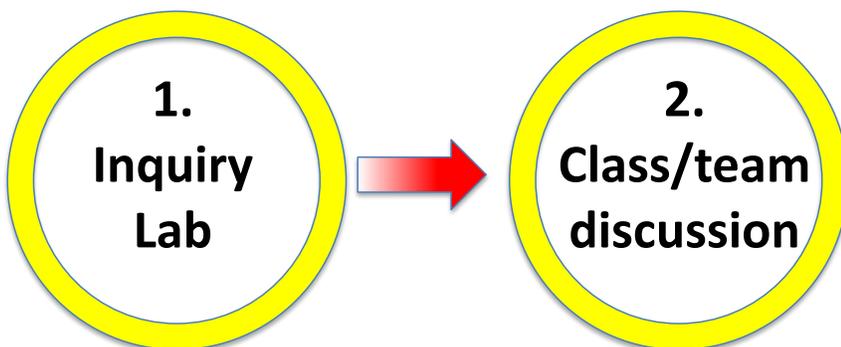


2. Class/team discussion:

*The group outlines their solution process on a large whiteboard/wipeboard. Tip: One marker per team- this enforces actual discussion.

*After lab, groups will share their varying methods, successes and struggles. What worked well, what didn't and why do we think this is?

*All groups benefit from the various solution methods and learn what works best.



3. Mini-Lecture:

*Students have been primed to identify the gaps in their current thinking, and have formulated questions that they are intrinsically motivated to know the answer to.

*All students walk out of the door with the same understanding of the central concepts being taught.



Your mission/task:

In your same groups as earlier, take all of the slips out of the bag.

- Read, discuss and sort all slips into **two, separate** categories based on your thinking.
- Come up with a name for each category.



On your whiteboard/wipeboard:

- 1) Write both category names you created at the top.
- 2) Then, write the number of each card underneath the category to which you think it belongs.
- 3) Write a sentence explaining the main difference between the two categories.

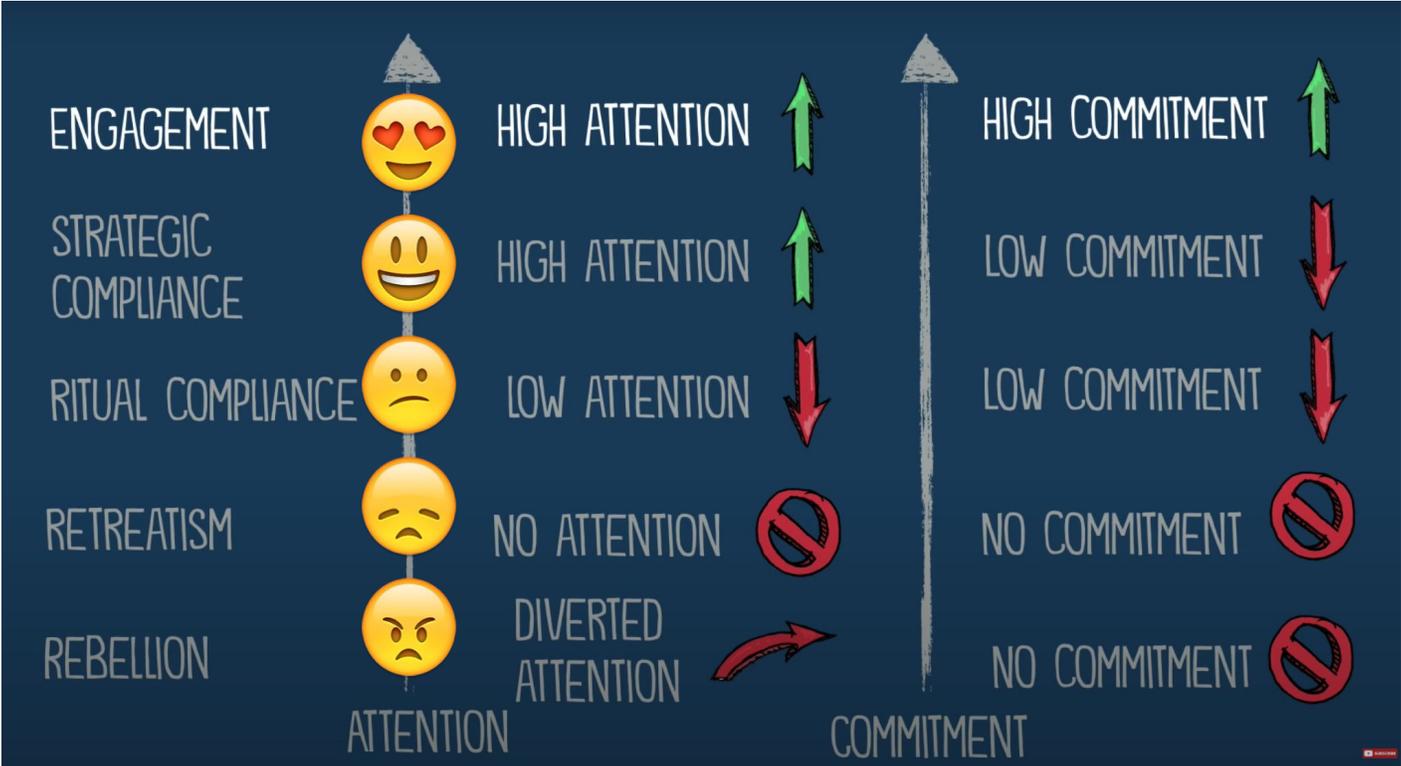
“Engagement is active. It requires the students to be attentive as well as in attendance; it requires the students to be committed to the task and find some inherent value in what he or she is being asked to do. The engaged student not only does the task assigned but also does the task with enthusiasm and diligence.”

-Phillip Schlechty

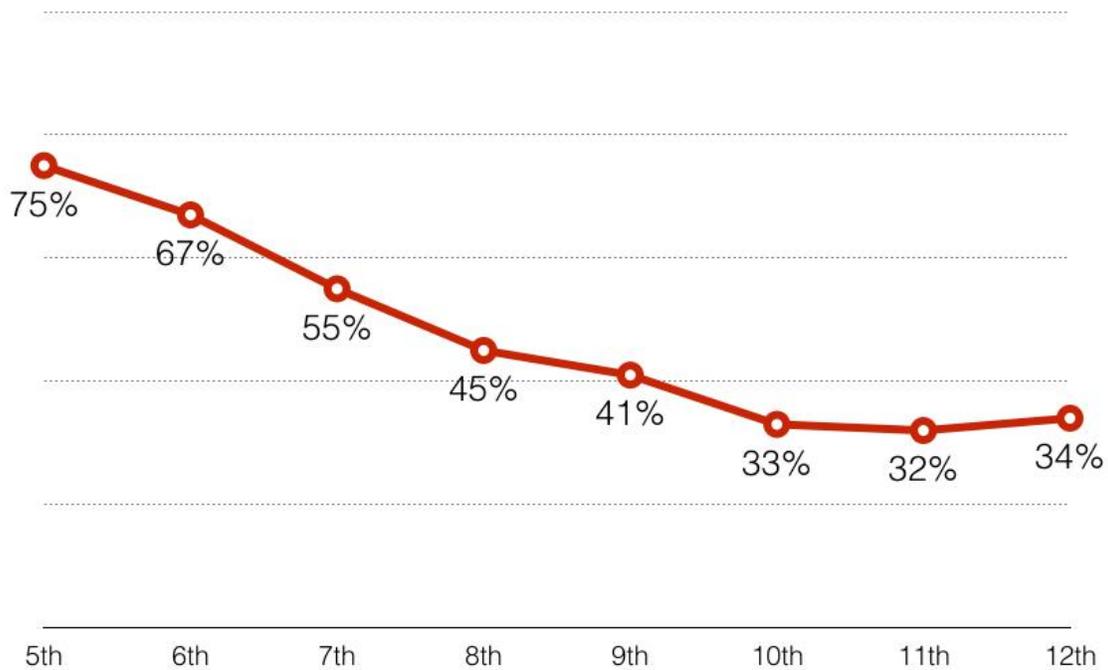
Philip Schlechty's

Levels of Engagement

Drawn by @sylviaaduckworth



Percentage of Students Engaged in School, By Grade (n = 928,888)



Gallup. (2016). *Gallup student poll. Engaged today - Ready for tomorrow. Fall 2015 survey results.* Washington, DC: Author.

“Activity Before Concept” Flow



- Activates their existing schema
- Stimulates intrinsic motivation
- Variety of solution methods produced
- Promotes high-level physical & mental engagement during activity, discussion and subsequent lecture

“Traditional” Flow



- Hands-on activities are fun
- Measures ability to follow directions
- Same solution methods produced
- High-level physical engagement, low-level mental engagement

Not everything needs to be/should be learned via inquiry:

Skills (How to?) vs Concepts (Why does?)



Classroom management tip:

Inquiry activities inherently promote freedom, debate, noise, physical activity.

Alternate Assignment:
Read pages 47-53 and
answer questions 1-6 in
complete sentences. Due at
the end of class.

