Case Study: Grade 7 Exemplar

Related NGSS Performance Expectation:

MS-ESS1-1: Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

Transcript

Part I:

Ms. Brady's 7th grade class is in the middle of a unit about the solar system. They have explored the relationships between the Earth, moon, and sun (i.e. the Earth orbits the sun, the moon orbits the Earth) and are now focusing on the lunar cycles. For the previous month, students have recorded their observations of the moon every night. Now, Ms. Brady starts by asking the students to share their observations.

Ms. Brady: Can someone tell me what they observed about the moon this month?

Steve: It's sometimes a round ball. It's white.

Sylvia: Sometimes it has that shape that looks like someone took a bite out of it.

Jordan: Oh, you mean a crescent?

Sylvia: Yeah, that shape.

Jen: I noticed that we see the same shapes over and over again.

Jordan: Right, but how come sometimes the "bite" in the crescent faces one way and sometimes it faces another way?

Jen: I've heard it has to do with whether the moon is getting bigger or smaller, but that confuses me because I'm pretty sure the moon isn't actually getting bigger or smaller. Ms. Brady, what is really happening?

Ms. Brady: Jen just provided us with an excellent question that we will explore further by first reading this journal article.

Ms. Brady explains that the students will be reading the article in groups. They will be looking for two things: Evidence about the lunar cycle, and Scientific Ideas about the lunar cycle. She asks them to underline the evidence and put a star next to science ideas. Ms. Brady reminds the students of their class definition of evidence, which is on a poster on the wall. It says that

scientific evidence is measurements and observations.

The students begin to work in small groups. Ms. Brady walks around to answer questions and listen to student conversations. She hears this discussion from one group:

Maya: This says, "For thousands of years people have observed that the moon's shape is predictable." Is that evidence? I'm going to underline it.

Ari: That sounds like a science idea to me, not evidence.

Maya: It's evidence because it's something people observed.

Ari: Okay, I agree with you now. What about this one? It says, "We know that these predictable shapes are related to the moon's orbit around the Earth." I think that's a scientific idea.

Part II:

Ms. Brady: So far we have observed the moon, and yesterday we used the journal article to better understand our observations about the lunar cycle. Today you are going to use what you learned to create a model that helps us understand why the moon looks different throughout the month. Your model can be a picture, an actual creation, or something on the computer, but it must be more than a pretty picture. It should show why we have a lunar cycle. You should work with your group to design your model. Keep in mind there is no one "right" way to do this.

Before the students begin to work, Ms. Brady provides a graphic organizer to help the groups plan their models. The graphic organizer has a section for students to write key ideas about the lunar cycle they want to include in their model and a section where students can sketch their model. Ms. Brady points out to students that they will want to make sure that their key ideas are represented in the sketch and then later in the model. She then listens as groups start to plan.

Wes: So, what are the key ideas?

Abby: How about that the moon orbits the Earth and the Earth orbits the sun.

Greg: Is that really important? Shouldn't we just focus on the shapes of the moon?

Abby: It is very important because we need to show why we see different amounts of the moon lit up.

Wes: Okay. I think another key idea is that the sun shines on the moon. We need to make sure everyone understands that the moon doesn't make its own light.

After the students have a chance to work on the graphic organizer, Ms. Brady provides the students with materials, such as various sizes of balls, clay, sticks, and flashlights. She also makes paper, markers, rulers, and protractors available. One group asks about using the computer for their model, so Ms. Brady lets them work on the computer in the classroom to make a PowerPoint.

Part III:

The students complete their models and do a gallery walk to see each other's models. During the gallery walk, the students take notes in a chart with two columns. The first column is for notes about the ways the different models accurately explain the lunar cycle. The second column is for notes about the ways the models either inaccurately explain the lunar cycle or leave out an important aspect of the lunar cycle.

Ms. Brady: We just had a chance to see each other's models and consider the ways the models do and do not explain the lunar cycle. Now we are going to have a debate to figure out together which model best explains why the moon looks different throughout the month. Your job is to defend your model or the model you think is best if it isn't yours, and persuade others why you think it is best. However, you might also change your mind as you hear others talk. That is fine – it is what scientists do as they debate their ideas. Can someone remind me of the norms we came up with as a class for these types of debates? Alicia?

Alicia: They are over there on the wall. We run the debate so we should take turns talking to each other and listen to what everyone is saying.

Ben: And try to ask questions too, not just say what you think.

Ms. Brady: Great. I am excited to see what we come up with. Sam, do you want to start?

Sam: I think that the computer model is the best one because it actually shows how things move in space.

Eliza: I agree with Sam that the motion helps, but I think there is something that isn't quite right about that model. It seems to show that the different phases are caused by a shadow from the moon. We read in the article the other day that the phases have to do with how much of the moon is lit up by the sun.

Gabe: We could try to change our model so it doesn't look like that. It's not supposed to. I read that part too.

Sam: My group drew a picture that definitely shows that the moon is lit up by the sun.

Gabe: Hey, we could use your picture in our model. We could put them together.

Nora: I completely disagree. My model is a better model because it shows that the moon is always in the sky. That's important. We read that some people think that it disappears. The computer model doesn't really make that clear.

Gabe: How did you decide what size to make the moon and the Earth? It looks to me like the moon is too small.

Hollie: Actually, Nora and I used the data from the article and made the Earth and moon to scale.

The debate continues and the students eventually reach consensus. They agree that they will use the computer model, but incorporate the picture from Sam's group and not have the moon disappear at any point. Instead, they decide to use an outline of the moon for daytime so it is still present in the sky, just not actually seen.