Kansas Curricular Standards | Science

#KSSCI http://bit.ly/2yaTBc5

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Science Assessment System Update

Below you will find resources from the KSDE Annual Conference to help you lead science education in your school district. Contact me if you have any questions!

1. Kansas Assessment Program

Learn more about the content emphasis, item specifications, and performance level descriptors for the state science summative assessment. Also find score report walkthroughs (same as math/ELA).

- KAP Science Site
- Score Report Walk Through

2. Vocabulary

Learn about the shift in use of vocabulary in science education. One of the most common topics surrounding the state assessment for science is vocabulary words. Check out the article, progression document, and evidence statements to help you identify key terms and how best to incorporate vocabulary instruction in science education.

- Vocabulary Article
- NSTA Disciplinary Core Idea Progressions
- Evidence Statements

3. Phenomena

One of the biggest shifts in science education is the use of phenomena to drive instruction. Find an overview of this shift and criteria to help you select phenomena for units of instruction.

There is also a great resource to help you screen lessons quickly to see if they have the big shifts our standards intend to make (includes phenomena).

- Phenomena Resources
- Lesson Screener Tool

4. Comparison of Two Science Classrooms

The two cases on the next page represent the major shifts these tools are helping us move towards. The resources I provided are helping us move towards Ms. Lee's class. What differences do you see?

Which class is LEARNING ABOUT and which is FIGURING OUT?

1. Where do the questions come from?
2. Who is involved in figuring out how to investigate the question?
3. How do students get to an explanation?

5. Advancing Coherent and Equitable Systems of Science Education

Research and practice 13-state partnership creating resources that will help with science education formative assessments.

- Types of Formative Assessment Brief
- ACESSE Resources
- Stem Teaching Tools

6. Science Education Newsletters

Register to receive state and national science newsletters to stay up to date with resources and quick PD ideas for implementation of the shifts in our standards.

- KSDE Science Newsletter Register Here (Bottom Left Hand)
- KSDE Science Newsletter Example
- NSTA Newsletter
- NGSS Achieve Newsletter (top right hand)

Case 1: Moon Phases in Ms. Sheridan's Class

The students come into Ms. Sheridan's class and find that the topic for the day is Moon phases. The day before this class, students had reviewed the order of the planets from the Sun. They had also made a chart of key characteristics of each planet.

After she introduces the topic of the day, Ms. Sheridan asks the students to raise their hands and when called on tell the class one thing they know about the Moon. Students offer ideas such as "I know we've sent rockets to the Moon" and "Isn't the Moon involved in tides?"

After three or four students have shared, Ms. Sheridan asks them if they have ever noticed that the Moon has different shapes at different times. She explains that the different shapes are called the "phases of the Moon" and puts up a list naming eight phases of the Moon. Next, she explains that today they are going to learn why the Moon's shape appears to change. She starts with the main facts about Moon phases: The phases occur in a cycle. The cycle is one revolution of the Moon around the Earth, about 28 days. She explains that the Sun is relatively far away from the Earth and the Moon. She shows the class how light from the Sun falls on the Moon, always lighting up exactly half of it. Then she explains that the part of the lit Moon you can see varies depending on where the Moon is in its orbit around the Earth. She shows the class a diagram on the smart board, walks them through the different steps in the Moon's orbit, and describes the phase that can be seen at that point in the orbit, along with telling students the name of each Moon phase that she expects them to learn.

Ms. Sheridan then tells the class that they can now try it out for themselves to see each phase of the Moon. She divides the class into eight groups and gives each group a small Styrofoam ball to represent the Moon and a larger blue ball to represent the Earth. Each group also gets a flashlight to represent the shining Sun. Ms. Sheridan gives each group one of the eight phases to prepare to demonstrate. Each group gets the name of a phase and a diagram showing the positions of the Moon, Earth, and Sun for that phase. The teacher gives each group five minutes to match the position of the Moon (the small Styrofoam ball), the Sun (flashlight), and the Earth (larger blue ball) to the diagram for its phase. She turns out the classroom lights, and students excitedly position the Moon and Sun to match their diagrams.

Then, each group shows the rest of the class its model of the positions of the Sun, Earth, and Moon for its phase. For homework, Ms. Sheridan asks students to make eight flashcards with a picture of a Moon phase on one side of the card and the name of that phase on the other. She lets them know that they will have a quiz the following day on this material and on the planets they learned about the previous day.

Case 2: Moon Phases in Ms. Lee's Class

The students in Ms. Lee's class have been working on near-Earth astronomy for a few weeks. They have been pursuing the overarching question "Why do the Sun, Moon, and stars move in our sky and change in appearance over time?" Recently, the students have been investigating the appearance of the Moon. They

wonder why it is visible in the sky at different times of day and appears some nights and not others. For over a month they have been spending a few minutes each day recording the appearance of the Moon on that day in a data table in their notebooks. As the Moon goes through the cycle of phases, the students learn the technical name of each phase. Prior to this lesson, they used moonrise time data to figure out that the Moon orbits the Earth in the same direction as the Earth spins, and it takes about a month to complete one orbit.

Ms. Lee begins class on this day with a discussion to help the students summarize what they have figured out so far and what questions remain about their observations. Ms. Lee draws their attention to the main question about the Moon that started them off on their investigation: "Why does the Moon change shape during the month?" The students have collected data about the Moon's appearance with the observations made throughout the month. They know that it takes the Moon 28 days to complete a cycle as it orbits the Earth, but they still haven't figured out why the shape changes during that time.

Based on what they have discovered so far, the class refines its original question to "Why does the appearance of the Moon change as it orbits the Earth?" The students brainstorm their initial ideas about why the apparent shape of the Moon might change, using what they have figured out about the orbit of the Moon around the Earth as a starting point. In the discussion, Ms. Lee raises the question of how it is even possible to see the Moon from Earth. Students draw on what they know about light sources and how light allows us to see and generally agree that it must be the light from the Sun reflecting off the Moon that makes part of the Moon visible from the Earth (since the Moon is not a light source). But students are not in agreement about why this would change as the Moon revolves around the Earth.

Ms. Lee suggests they try to picture what is happening as the Moon goes around the Earth and recommends they use physical props to see for themselves why the shape might appear to change. Students like the idea and are eager to see what would happen to light from the Sun as the Moon orbits the Earth. As in earlier modeling activities in their classroom, Ms. Lee has the class agree on the question the model needs to explain and then brainstorm what needs to be represented in the model. In discussion, students decide they need to represent the Earth, the Moon, and the Sun. Ms. Lee gives each group of students a Styrofoam ball and says that they can use the ball to represent the Moon. She suggests using a lamp she has without the shade to represent the Sun and places it in the center of the room so all the kids can use its light in their investigation (she also covers the windows so that the lamp "Sun" is the only light in the room). Since the goal of the activity is to see what the Moon looks like from Earth, Ms. Lee helps the students come up with the idea of using the ball and their own bodies to simulate the Moon's orbit around Earth (recalling what they had already figured out about that from the moonrise times). Before they begin, Ms. Lee asks students to state what they are trying to figure out and how they will use the props to test their ideas. The students agree that they need to figure out what parts of the Moon they can see in each part of the orbit.

The students talk actively as they engage and make notes about what they can see from each position. Once they have collected all their evidence and reported on it, the students are ready to try explaining the phenomenon. Ms. Lee asks them to discuss in their groups and draw a representation on their poster paper that shows why the Moon's appearance changes over the course of the month. Once each group has finished, she has the students put up their diagrams around the room. They do a gallery walk so they can all see what the other groups have created. Then the students spend time in their groups talking about what they have seen, trying to identify where they have agreed or disagreed with other groups and what makes for a good representation. As a whole class they then discuss the differences among the various explanations and how they have represented them. The teacher guides a discussion to help the students decide on a consensus explanation and a way to represent that explanation in a diagram. Ms. Lee tells students that their homework

for the day is to write a short paragraph that they could use to explain to a friend from a different class why we see phases of the Moon from Earth. The next day in class they apply their ideas by finding pictures in children's books that should be drawn differently based on their knowledge of the Moon and its phases.

Icon Credit Noun Project: Competitor Analysis by Yu Luck, Unlock by David Gomez, Speak by Benjamin Harlow, All Seeing Eye by Kyle Tezak,

Comparison of Two Science Classrooms Credit: Schwarz, C., Passmore, C., & Reiser, B. J. (2016). Helping students make sense of the world using next generation science and engineering practices. Arlington, VA: National Science Teachers Association