

## When Is the Next Full Moon? Using K–2 Concept Cartoons

By Page Keeley

Concept cartoons, formative assessment tools that reveal students' preconceptions and probe for conceptual understanding (Naylor and Keogh 2000), have recently become popular in the United States, with teachers developing their own versions. "When Is the Next Full Moon?" (Figure 1) is an elementary science probe with a concept cartoon format (Keeley 2013). This format provides an engaging, visual

stimulus for eliciting students' ideas. It also serves as a starting point for their investigation. Characteristics of concept cartoons that make them effective formative assessment tools for younger students include:

- a visual format with minimal text
- characters talking with each other, each sharing a different idea

- familiar contexts or situations
- a "What are you thinking?" prompt to encourage students to share their ideas and explanations in a science talk format

### Content Connections

The K–2 Earth and space science *Next Generation Science Standards* (NGSS) include the disciplinary core idea that patterns of the motion of the Sun, Moon, and stars in the sky can be observed, described, and predicted (Achieve Inc. 2013; see Internet Resource). "When Is the Next Full Moon?" is designed to address one component of this core idea—observing, describing, and predicting the monthly pattern of Moon phases. Let's explore how the concept cartoon format helps students develop this important understanding and prepares them to meet the NGSS grade 1 performance expectation 1-ESS1-1 Use observations of the Sun, Moon, and stars to describe patterns that can be predicted (Achieve Inc. 2013; see Internet Resources). Current state standards contain similar assessment expectations.

This probe may be used at the start of a unit on observing the pattern of Moon phases (ideally on the date when there is a full Moon). First, make sure students know what a full Moon is, and then present the

Children are continually developing ideas and explanations about their natural world. Many of these ideas come from their daily interactions with natural phenomena. Others come from ideas they pick up through the media, other students, and adults. Some of these ideas are consistent with the science children are taught; others differ significantly from scientific explanations. Many of these ideas will follow students into adulthood if they remain hidden from the teacher and unresolved. The challenge for teachers is to find ways to elicit these ideas and then use appropriate strategies to move students' learning forward. The *Uncovering Student Ideas in Science* series, published by NSTA, provides K–12 teachers with a source of highly engaging science questions that link instruction and assessment and target key ideas in the standards. These questions, called formative assessment probes, are used to expose students' preconceptions; encourage evidence-based explanations, talk, and argument; and monitor students' progress in achieving conceptual understanding. Combined with various formative assessment classroom techniques (FACTs), probes not only assess where students are conceptually, they also promote learning and inform effective teaching. This is the essence of formative assessment. Each month, this column features a probe and describes how elementary science teachers can use it with effective strategies to build their formative assessment repertoire and improve teaching and learning in the elementary science classroom. See NSTA Connection for more background on using formative assessment probes.

cartoon. Working with a partner or in a small group, students decide which character they most agree with and why. The teacher then engages the whole class in science talk, listening carefully as pairs or small groups share the character they most agree with and explain their thinking, taking note of ideas students may have about Moon phases that can be used to inform subsequent instruction. The teacher then challenges the class to come up with a way the class could investigate to find out which cartoon character has the best idea about when a full Moon will appear again.

Through discussion, you should now have a record of understandings and misunderstandings students have about the pattern of Moon phases that can be revisited after the students have had an opportunity to observe, analyze their data, and revise or refine their initial claim and explanation. Consider whether some of the students have limited opportunity to see the night sky, and make note of times during the day the class can go outside to see the Moon or when students may have to use digital media to make their observations. As the class plans for and engages in an investigation to record and describe the daily changes to the shape of the Moon, they are using two of the scientific practices in the NGSS: (1) planning and carrying out investigations and (2) analyzing and interpreting data. These practices are further explicated for grade 1 as:

- Make observations (firsthand or from media) to collect data that can be used to make comparisons.
- Use observations (firsthand or

**Figure 1.**

**“When Is the Next Full Moon?” formative assessment tool.**



from media) to describe patterns in the natural world in order to answer scientific questions (Achieve Inc. 2013, p. 14).

### What’s Next?

A critical feature of formative assessment involves giving students feedback. As students plan and carry out their Moon investigation,

provide feedback to individuals and groups on their use of the scientific practices. This feedback is designed to move their learning forward so that they gain proficiency in the use of the practices to develop understanding of the scientific content.

After students have completed their investigation, the class comes together to analyze the data and discuss which probe character they

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now agree with and how the evidence from their observations support the character's idea they chose. They revisit some of the earlier alternative ideas shared during the preinvestigation discussion and talk about how their views have changed, sharing the evidence that helped them change their ideas. They decide whether observing one cycle is enough to support the class's theory that the Moon goes through a pattern of phases about every four weeks. They also raise additional questions, which often provide further insight into their thinking. To make sure that students can apply their knowledge using the data from their investigation to make predictions, ask new questions such as, "If there is a crescent Moon today, how long will it be before we see the same shape Moon again?" and "If there is a full Moon today, how many days will it take until we can see a crescent Moon?" All of the formative assessment data the teacher collects throughout the Moon phase investigation feeds into the summative assessment question, "Are my students ready to demonstrate that they can meet the Moon part of the performance expectation?" (1-ESS1-1 Use observations of the Sun, Moon, and stars to describe patterns that can be predicted.)

The concept cartoon format is particularly effective for formatively assessing students' readiness to meet this NGSS performance expectation as it provided a visual starting point for eliciting and sharing their initial ideas, launched them into an investigation that took their initial ideas into account, and provided an opportunity to revisit

their initial ideas using evidence from data collected through the investigation and explanations developed through the sense making discussion. Throughout the full cycle of formative assessment, the concept cartoon provided an engaging way for students to learn that the pattern of Moon phases takes about four weeks and to use the scientific practices to develop that knowledge. It also provided a way for the teacher to gain access to students' ideas, including their misconceptions, and look for evidence of whether and how their ideas had changed or developed further as they progressed through their investigation.

As you start this new school year, consider developing your own concept cartoons or using ones that are already published to engage your students, provoke productive classroom discussion that uncovers their existing ideas, stimulate their scientific thinking, and launch them into purposeful investigations that address core ideas in science. In this way, a formative assessment probe becomes a valuable and deliberate part of the elementary science teaching and learning process. ■

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## References

- Achieve Inc. 2013. *Next generation science standards*. [www.nextgenscience.org/next-generation-science-standards](http://www.nextgenscience.org/next-generation-science-standards).
- Keeley, P. 2013. *Uncovering student ideas in primary science, volume 1*:

*25 new formative assessment probes for grades K-2*. Arlington, VA: NSTA Press.

Naylor, S., and B. Keogh. 2000. *Concept cartoons in science education*. Cheshire, UK: Millgate House Publishers.

## Internet Resource

NGSS Table: 1-ESS1 Earth's Place in the Universe  
[www.nextgenscience.org/1ess1-earth-place-universe](http://www.nextgenscience.org/1ess1-earth-place-universe)

## NSTA Connection

Download the "When Is the Next Full Moon?" probe at [www.nsta.org/SC1309](http://www.nsta.org/SC1309).

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