

# THE MOON CHALLENGE



A first-grade research project incorporates trade books and challenges misconceptions.

By Pat Fitzsimmons, Diana Leddy, Lindy Johnson, Sue Biggam, and Suzan Locke

Rachel Carson asserted, “If a child is to keep alive his inborn sense of wonder, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement, and mystery of the world we live in” (Burchac 2004). As educators we know this to be true; we see the power of our students’ wonderings at work in our classrooms on a daily basis. This wonder must be nourished by students’ own experiences—observing the Moon on a crystal clear night—as well as by having their understanding informed by the

thinking and experiences of others. The questions scientists ask require collective inquiry and accumulated knowledge, the thoughtful analysis and synthesis of many minds. *A Framework for K–12 Science Education* asserts that “Science

cannot advance if scientists are unable to communicate their findings clearly and persuasively or to learn about the findings of others” (NRC 2012, p. 53). It also reminds us that “Reading, interpreting, and producing text are fundamental practices of science in particular, and they constitute at least half of en-

*Do you wonder, when you see the Moon,  
at dusk or dawn or midday noon,  
just why her face is curved, or round,  
or why she sometimes can’t be found?*

—*Faces of the Moon* (Crelin 2009)

gineers' and scientists' total working time" (NRC 2012, p. 74). The science and engineering practices in the *Next Generation Science Standards (NGSS)* offer additional guidance for educators (Achieve Inc. 2013). Students need opportunities to collect data through observations, compare data, and answer questions by describing patterns in data.

Work in our classrooms, then, must be integrated across science and English language arts to meaningfully connect scientific inquiry with analytic reading, writing, and research skills. A group of Vermont educators decided to take on the challenge of integrating science and literacy by developing a first-grade research project about the Moon. Working from the NGSS disciplinary core idea ESS1.A, which states that students will be able to describe and predict patterns of motion of the Sun, Moon, and stars (Achieve Inc. 2013; see Internet Resources), we narrowed the topic and developed a research question: When you look at the Moon, how does the shape seem to change over time? Our lesson sequence, which combined observation and work with nonfiction texts, was designed to help students observe patterns of change and understand that although the shape of the Moon appears to change, it really remains the same. Work in this unit centers on the crosscutting concept of patterns and employs the science practices of asking questions; developing and using models; analyzing and interpreting data; and obtaining, evaluating and communicating information (NRC 2012, p. 49)

## The Development Process

We began this effort by crafting a template for a short focused research project that would guide our decisions. The template (see NSTA Connection) starts with the end in mind and follows many of the backward design principles that are familiar to educators. The goal was to intentionally weave together the NGSS and English Language Arts/Literacy *Common Core State Standards* (these are included on the template available online).

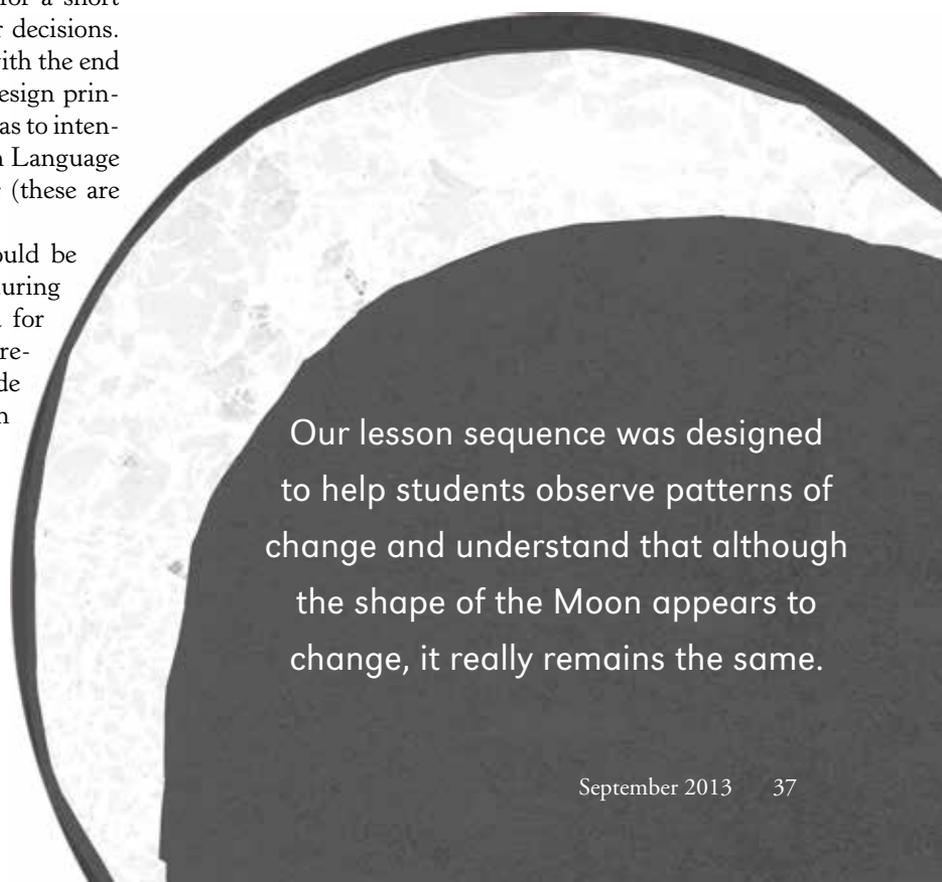
We identified the science content that would be the focus of this project and generated an enduring understanding that summarized the big idea for this project. The enduring understanding was rephrased into a question composed of first-grade friendly language, and that became our research focus. Sub-questions intended to scaffold the content for students were also developed. Next, we reviewed the reading, writing, speaking/listening, and language standards to identify those that would be used to inform both instruction and assessment. Since Vermont is a member of the Partnership for 21st Century Skills (see Internet Resources),



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**Children used chalk to record the phase of the Moon described by the texts.**

we also selected a communication outcome that aligned well with our speaking and listening standards. Learning intentions that describe what students will know, understand, and be able to do were identified to clarify the outcomes we hoped to achieve. Once student outcomes came into focus, we were able to construct formative as-



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Keywords: Moon Phases  
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assessments that would allow us to track student progress. Summative assessments, included in the short focused research project template (see NSTA Connection), were also designed to determine student understanding of targeted concepts.

Now we were ready to work on the instructional plan. We gathered a variety of books about the Moon and read each one. Although there are a number of wonderful Moon resources, our goal was to identify a core group of texts that would help move student thinking toward the enduring understanding that we had identified and provide evidence for students to answer the research question. Each person chose their favorite three books and justified their thinking. This process helped to eliminate a number of potential resources and identify the essential texts for this project. We wanted to respect the idea of a short research project and that choice also guided some of our decisions. Once the books were selected, we decided upon the reading sequence and identified two texts that would be the focus for close readings supported by text-dependent questions (see Resources). *So That's How the Moon Changes Shape* (Fowler 1991) and *Finding the Moon* (Delta Science Readers 2003) would be read at the beginning of the project to develop shared background knowledge about the Moon. *Papa, Please Get the Moon for Me* (Carle 1986) provided an assessment opportunity and would therefore be read near the beginning of the project and again at the end of the project to see if children could differentiate fact from fiction within the text. The final two books, *Phases of the Moon* (Olson 2007) and *Faces of the Moon* (Crelin 2009) were the main focus of this project and would be revisited a number of times.

## Let's Pause for a Moment. . .

In order to explain our work in an understandable way, we are describing this process in a linear fashion. In real-time, however, it was a little messier. There were many conversations and refinements that took place. For instance, our first attempt at a research question was not the final version. Our initial question was too big and needed to be narrowed to a specific focus. When teachers piloted this project with students, additional revisions were made. As new sets of eyes review this work, we suspect another set of refinements and improvements will occur, and we look forward to hearing those suggestions. This template should not be viewed as a script, but rather as a guide that will be adapted, enhanced, and improved in order to meet the particular needs of various groups of students.



After completing their Moon models...



... students sequenced and labeled them on a long strip of black paper.

## The Moon Instructional Plan

*So That's How the Moon Changes Shape* and *Finding the Moon* were read aloud to the class. Children's ideas about the Moon were then elicited through a gathering ideas discussion guided by the focus question, "Based on these books, what do you think you know about the Moon?" *Papa, Please Get the Moon for Me* was read next. Children gained additional information about how the Moon appears to change over time. Book bags that included a science notebook as well as some of the Moon books were also sent home in order to engage families in our research.

A note to parents informing them of our work and guiding their support from home was written on the first page of the science notebook:

“We are studying the Moon in school and need your help. Please take some time to read these books and then go outside to observe the Moon. Children should draw their observation of the Moon and record the date and time in the science notebook. The bag should be returned to school the following day.”

Because it was challenging for some students to observe the Moon at night, an iPad app, Live Moon (Live Moon Pro version 2.0 iPad App. Moon PreviewAp), allowed students to look closely at the Moon in class and record their observations.

Additionally, children started noticing when the Moon was visible in the daytime sky. Digital pictures were taken that allowed children to compare their scientific drawings to what they observed during the day. As children became more knowledgeable about the phases of the Moon, they were asked to make predictions about how the Moon would look the following day and support their predictions with evidence from their observations.

Discussions about the texts as well as student observations provided essential opportunities to check children’s current thinking and build an initial understanding about how the Moon appears to change over time. A “Moon Probe” along with a gathering ideas discussion at the beginning of the project elicited valuable information. Children were asked to draw how they think the Moon changes over time and then bring their drawings to a “scientists meeting.” Through their drawings and discussion, children demonstrated that they actually knew quite a lot about the Moon, but also showed some confusion about the pattern of change in the Moon’s appearance. Children explained how some nights the Moon looked big and round, while on other nights they could only see part of the Moon. As the class discussions started to come to an end, one child admitted that he still thought the Moon was made of cheese. This provoked a chorus of agreement from classmates. They appeared to have one foot in the scientific world while still being influenced by the world of make-believe. There was work to be done!

After reading the foundational books and discussing ideas, students seemed ready to dig a little deeper into two texts that were selected for close reading.

## Digging Deeper

For this part of the project, we expanded our thoughts about young children’s note taking to include drawings that would represent their interpretation of text. These “notes”



**The class celebrated everyone’s new learning about the Moon!**

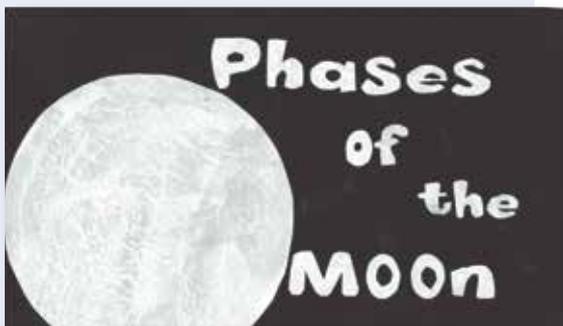
prompted active listening during the read aloud and produced a written record that could be referred to when talking or writing about Moon observations. We wanted children to be able to manipulate their notes so they could demonstrate their understanding of the Moon’s pattern of change over time. Black construction paper circles were the perfect solution! At each close reading session, children were given a black circle (Moon model) and chalk for drawing the phase of the Moon that was described by the texts. An envelope for storing their notes was also provided. We now were ready for a thorough investigation of two texts.

*Faces of the Moon* and *Phases of the Moon* were initially read aloud by the teacher in their entirety. This provided students an opportunity to appreciate the language of the texts and hear a fluent reading of each one. Next, key phrases that referred to a specific phase of the Moon were selected from each text. As the descriptions were read, students listened closely to the words of the texts and discussed the clues that the authors provided. They noticed that the authors used the words *smile* and *banana* to describe the shape of the crescent Moon.

Children used chalk to draw this phase on their black construction paper circle that served as a model of the Moon. Students were then able to compare their work to the illustrations in the books and make revisions if necessary. Each child kept their Moon phase notes in an envelope so, at the end of this project, they could reconstruct the pattern of how the Moon appears to change over time. This note-taking process was repeated for each phase of the Moon.

Initially, finding clues by listening only to the words was a challenge for students, but with practice their ability to accurately record the appropriate phase improved dramatically. These books were selected because their language was precise and encouraged visualization of the targeted Moon phase such as those in the book *Phases of the Moon* (“The next phase looks like a banana. It’s called a

## Class report.



Then comes a **crescent moon**.  
It looks like a smile or a banana.



The moon seems to be getting bigger.

Then comes a **quarter moon**.  
It looks half lit up.



The moon seems to be getting bigger.  
bigger.



Then there is a **full moon**.  
It looks all lit up and round.

crescent Moon,” [Olson 2007, p. 10]) and the poem *Faces of the Moon* (Crelin 2009):

A few days pass, and Moon’s less shy;  
her smile lights the twilight sky.  
The more her sunlit surface shows,  
the more Moon’s WAXING CRESCENT grows.

In addition to the individual science Moon notes that were drawn on the black construction paper circles, students’ descriptions of the phases of the Moon were recorded throughout this project in order to begin constructing a class report. The opening paragraph that answers the research question was developed at the end of the project during a class meeting (see NSTA Connection for the full class report).

“Research Question: When you look at the Moon, how does the shape seem to change over time? We observed the Moon and then read books to learn more about what we saw. We found out that the Moon doesn’t really change shape. The change is just how much of the Moon you can see.”

At the end of the report, they summarized their findings.

“Then the whole thing happens all over again. First the Moon seems to get bigger, then the Moon seems to get smaller. It’s one of nature’s awesome patterns!”

Since the report required students to accurately identify the phases of the Moon and provide additional descriptive language about each phase, teachers were able to assess and reinforce student understanding of the Moon phase vocabulary that was introduced throughout the study. Although there were some initial concerns about certain vocabulary, like *gibbous*, first-graders eagerly embraced the new term!

## Assessing Learning

In order to assess individual students’ understanding of the pattern of change over time, children sequenced their Moon phase notes, the black circles with the chalk illustrations, on a long strip of black paper and added a label to identify each phase. Although a number of students had initially predicted that the new Moon would reappear after the full Moon, their thinking had changed over the course of this project, and most sequences accurately reflected the pattern of the Moon phases. Students had moved forward in terms of their thinking about the Moon.

Students also revisited *Papa, Please Get Me the Moon* and discussed the following prompt:

The book mentions that the Moon got smaller and

smaller and finally disappeared altogether. Think about what you have learned about the Moon. Do you agree or disagree with the author? What is your evidence?

One class even wrote a note to Eric Carle explaining that his book contained statements about the Moon that are not true. They used evidence from their research to support their argument but ended the letter by thoughtfully encouraging Eric Carle to continue writing children's books!

## Why Bother?

Teachers are extremely busy and pulled in a variety of directions. Why should we bother to incorporate short focused research projects into classroom practice? Isn't life in the classroom already challenging enough? How can we find the time to construct these projects?

These are all excellent questions, but let's think about the benefits of short focused research projects. First, the NGSS call for the integration of science and engineering practices, crosscutting concepts, and disciplinary core ideas (Achieve Inc. 2013). We also need to consider the *Common Core State Standards* in English language arts. They require three major instructional shifts that include:

- Complexity: Regular practice with complex text and its academic language
- Evidence: Reading, writing, and speaking/listening grounded in evidence from text, both literary and informational
- Knowledge: Building knowledge through content-rich nonfiction across the curriculum

Short focused research projects enable teachers to address all of these expectations in a meaningful and engaging way. They provide a context for integrating content with English language arts and making conceptual understanding accessible to all students. Additionally, the *Common Core State Standards* have ushered in a new era for education. For the first time in our history, we can share materials across state lines that are aligned to the same set of standards. Let's take advantage of this opportunity. It is definitely too hard and time-consuming to do this work alone, but as teams of educators we can work together to construct significant, integrated research projects for our students at all grade levels. If educators across the country start with the goal of creating and sharing just one short focused research project, think about the possibilities. Are you ready to take on this challenge with your colleagues? ■

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## Internet Resources

- 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)
- Partnership for 21st Century Skills. Framework for 21st Century Learning  
[www.p21.org/overview/skills-framework](http://www.p21.org/overview/skills-framework)

## Moon Project Resources

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## NSTA Connection

Visit [www.nsta.org/SC1309](http://www.nsta.org/SC1309) for the project template (including CCSS) and the class report.