

The MOON in Children's Literature



*How to avoid the pitfalls of
introducing misconceptions
when reading about the Moon*

By Kathy Cabe Trundle
and Thomas H. Troland



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The Moon's cycle of phases is one of the most familiar natural phenomena, yet also one of the most misunderstood. This probably comes as no surprise, but research has found that a significant segment of the population, including both elementary students and teachers, mistakenly believes that the Moon's phases are caused by the shadow of the Earth. (In reality, the Earth's shadow only falls upon the Moon once or twice per year during a lunar eclipse.)

Not even graduates of Harvard University understand lunar phases. In the thought-provoking video *A Private Universe* (1988), crimson-robed students and even a professor are interviewed on graduation day about the origin of the phases of the Moon. Although one student said he had taken astronomy and advanced physics at Harvard, he could not correctly explain the true nature of Moon phases. Nor could most of his colleagues. Nor could the professor, who, we assume, was not a professor of astronomy.

Science educators are aware of the misconceptions surrounding lunar phases. The *National Science Education Standards* state that elementary students often have a clear understanding of the shapes and relative positions of the Sun, Earth, and Moon, yet they are unable to use this information to explain Moon phases (NRC 1996).

Instruction on Moon phases is prevalent from elementary science through college astronomy courses—and part of science standards at the local, state, and national levels. Moon phases are included in Earth and space science curricula and textbooks and even featured in children’s literature. With educators increasingly promoting the use of children’s literature to teach science concepts and primary teachers frequently integrating popular books into science units, caution about content accuracy must be exercised when choosing science books for children.

Our research confirmed this when we evaluated 79 children’s books that focused on the Moon as a topic or used the Moon prominently in illustrations; our results revealed that many books reinforce misconceptions about lunar phases and even misrepresent the Moon.

Perhaps it seems unreasonable to complain about depictions of lunar phases in children’s books. These books are literature, not science. And it would seem extreme as well to complain about Van Gogh’s exaggerated stars in *Starry Night*. Yet education strives, among other things, to convey an accurate understanding of the natural world. Teachers who use children’s literature that misrepresent the Moon may inadvertently be introducing misconceptions.

We undertook this study and article to make teachers, parents, and library media specialists aware of potential problems. Here, we discuss specific examples of children’s literature and what do about this problem with some specific tips for the classroom.

Case Studies

From the 79 books we analyzed (See NSTA Connection, page 45), two notable examples of children’s books, *Papa Please Get the Moon for Me* by Eric Carle (1986) and *Moonbear* by Frank Asch (1993), were selected for in-depth critical analysis because of their availability to classroom teachers.

First, consider *Papa Please Get the Moon for Me*. Described on the book jacket as a “first lesson in natural history, depicting the eternal cycle of the waxing and waning of the Moon” and as “entertaining yet educationally sound,” the book completely misrepresents lunar phases. For example, illustrations in the book of the waxing and waning Moon show crescents that change in size, contrary to everyday observation. Other illustrations show the crescent Moon as cutouts, with stars in the area where the unlit part of the Moon should be.

The title page includes a pictorial representation of the sequences of Moon phases from crescent, to

quarter, to full, to quarter, and to crescent. However, if the reader interprets the drawings from left to right, as is typically done, the proper sequence is reversed from the Northern Hemisphere perspective, with the waning phases preceding the full Moon and the waxing phases following the full Moon. If teachers and parents use this book to teach Moon phases, inaccurate conceptions may be instilled or reinforced.

Another example of children’s literature that misrepresents the Moon is *Moonbear* (Asch 1993). In this book the gibbous Moon, or as Asch calls it, “the three-quarter Moon,” is inaccurately drawn. The illustration does not represent any ordinary phase of the Moon. Instead, it represents the partial phase of a lunar eclipse. That is, the illustration shows the Moon partially within the Earth’s shadow. This misrepresentation of the Moon is likely to reinforce the common misunderstanding that lunar phases are related to shadows. In other parts of *Moonbear*, the lunar phases are mislabeled, and a pictorial representation of the lunar phase sequence is reversed from a Northern Hemisphere perspective, with the waning phases preceding the full Moon.

Clearly, text as well as illustrations in children’s books misrepresent reality and have the potential to reinforce inaccurate conceptions of lunar phases.

Addressing the Problem

Given that children’s literature is likely to include misrepresentations of the Moon, how might teachers use children’s literature when teaching Moon phases?

There are several options. For one, teachers can continue to use these popular books, integrating them into inquiry-based instruction on Moon phases. In this approach, students first make regular observations of lunar phases, then follow up with a comparison of their observations to a book’s illustrations.

To begin the instruction, teach students the procedures for gathering, recording, and sharing Moon observations. First, take them outside the school building and orient them to cardinal directions (i.e. north, south, east, and west) with the use of landmarks in the community. This information will be important in helping the children determine the direction they later look to see the Moon.

Next, explain and model how to gather and record observational Moon data. On days when the Moon is visible, all students should make a Moon observation and record a drawing of the shape of the Moon, the time of the observation, and the direction they looked to see the Moon. Moon data can be recorded on a “Moon calendar” which has a circle for each day in which the children sketch the shape of the Moon and blanks for the time and cardinal direction.

The children should record Moon observational data over nine weeks for days when they are able to observe the

Figure 1.

Thinking questions for *Papa, Please Get the Moon for Me* by Eric Carle (1986).

- Compare your Moon data to the illustrations in the books. How are they similar and how are they different?
- Look at the Moon sequence on the title page. How does this sequence compare to your Moon data?
- Look at the Moon illustration on the second page of the story. This is the author's representation of a full Moon. How does this illustration compare to your data for a full Moon? What would scientists be more likely to call the Moon phase in the illustration?
- After the big foldout page of the full Moon, the Moon gets "smaller and smaller and smaller" on the next six pages. How do the illustrations compare to your data when you were seeing less and less of the Moon?
- After the Moon "disappeared altogether," "Monica saw a thin sliver of the Moon reappear." On the next four pages the Moon "grew and grew and grew" until it was full again. How do these illustrations compare to your data when you saw more and more of the Moon?
- Look at the Moon illustration on the last page of the story. This is another of the author's representations of a full Moon. How does this illustration compare to your data for a full Moon? What would scientists be more likely to call the Moon phase in the illustration?
- Look at all of the Moon illustrations. At what time of day is the Moon mostly represented (day or night)? How does this compare to your Moon data?
- Look carefully at drawings in the book of the Moon at different phases. Compare these drawings with your own observations of the sky. Do you think the book's drawings of different Moon phases mostly match your drawings or not? Describe how the drawings in the book match or do not match your drawings.

Moon. This time frame will allow the children to see the repeating pattern of Moon phases for two lunar cycles.

Once a week during the observation period, have students share their Moon data as a class. To facilitate the data sharing and discussion, draw seven circles on the chalkboard, and children can share data by replicating sketches from their "Moon calendar," including the

dates, times, and directions for their observations. On days when the Moon is not observed, the sky may be overcast, but on other days it will not be. These conditions should be noted. Then, the children can look for anomalies in the shared data. Examples include drawings made by two different students on the same day that are very different in shape or orientation to the horizon.

After the nine-week period of recording and sharing data, the children are ready to analyze their data and look for patterns. After describing daily and monthly patterns, they can sketch a sequence of shapes over a month and note that the Moon is not visible during some 24-hour periods, even if the sky is clear. Then introduce the term "phases" for the different shapes. Describe the epoch in the monthly cycle when the Moon cannot be seen as "new Moon." Also introduce the other terms describing lunar phases such as *crescent*, *first quarter*, *gibbous*, *full*, and *third quarter*, and distinguish between *waxing* and *waning* Moons.

After gathering and examining Moon data, students can compare their observational data to the illustrations in books and look for differences:

Figure 2.

Thinking questions for *Moonbear* by Frank Asch.

- Compare your Moon data to the illustrations in the book. How are they similar and how are they different?
- On the second and third pages of the story, Moonbear loves the Moon "when she's new." How does this illustration of a new Moon compare to your Moon data for a new Moon? What would scientists be more likely to call the Moon phase in the illustration?
- On pages four and five, Moonbear "loves her when she's half." How does this illustration compare to your Moon data for a "half Moon?" What would scientists be more likely to call the Moon phase in the illustration?
- On pages six and seven, Moonbear "loves her when she's three-quarter." How does this illustration compare to your Moon data for a "three-quarter Moon?" What would scientists be more likely to call the Moon shape in the illustration?
- Look at the sequencing of the Moon shapes throughout the book. If the illustrations are intended to show the passage of time, is the Moon waxing or waning throughout the story? How does this sequence compare to your Moon data?

- Do crescent Moons really grow in size (as if the Moon were coming closer to us)?
- Can you really see stars in the unlit portion of a crescent Moon?

Observant students will realize that the answer to both questions is “no” despite the illustrations they may see in books. As a result, students not only understand lunar phases, they also gain practice in critical judgments of printed materials. We’ve found this instruction highly effective at helping children and teachers develop a scientific understanding of lunar concepts. Figures 1 and 2, page 42, list several sample thinking questions to use when analyzing the books described in this article.

Selecting Books

Of course, there’s always the option of using a nonfiction book that scientifically represents Moon phases. One book that treats lunar phases accurately is *The Moon and You* by E.C. Krupp and R.R. Krupp (1993). This book contains a wealth of information about the Moon’s physical nature, phases, orbit, and eclipses. It also includes additional information about the Moon, including Moon legends and beliefs among various cultures through history.

To ensure effective science instruction, any book must be used along with experiences of observing the Moon and the inquiry-based instructional techniques described above.

Nonfiction books about the Moon may also serve as a resource for teachers who wish to review the concepts of lunar phases themselves so that they can accurately describe the phenomenon. Other factual books on this subject include *The Moon* by Seymour Simon (2003) and *The Moon Seems to Change* by Franklyn Branley (1987).

When selecting books for your classroom, begin by comparing the illustrations in the books to the photographic images of the Moon available from the U.S. Naval Observatory (see Internet Resources). The following questions may be helpful in further evaluating Moon illustrations:

- How do the illustrations compare to the photographic images?
- Does the illustrator include other celestial bodies like stars or other objects in the space where the unlit portion of the Moon should be? and
- How does the *sequence* of the Moon illustrations compare to the photographic images?

Getting It Right

With Harvard graduates so blissfully ignorant, who can fault children and adults for misunderstanding phases of the Moon? Yet an understanding of this phenomenon can

be achieved with proper instruction, and children’s literature can be effectively integrated into the instruction.

The familiar cycle of lunar phases, so beautiful and so evocative to the human race, is a phenomenon of nature that begs understanding. With careful observation of the sky, modeling, and some skillful guidance from their teachers, children can comprehend and appreciate this celestial cycle that is so much a part of human culture and experience—and do so with accuracy. ■

Kathy Cabe Trundle (trundle.1@osu.edu) is an assistant professor of Early Childhood Science Education at Ohio State University in Columbus, Ohio. Thomas H. Troland (troland@pa.uky.edu) is a professor of physics and astronomy at the University of Kentucky in Lexington, Kentucky.

Resources

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Internet

Moon Images
http://aa.usno.navy.mil/graphics/Moon_phases.jpg

NSTA Connection

To read more about how the Moon books were evaluated, click on this article at www.nsta.org/elementaryschool#journal.

Connecting to the Standards

This article addresses the following *National Science Education Standards* (NRC 1996):

Content Standards

Grades K–4

Standard D: Earth and Space Science

- Objects in the sky
- Changes in Earth and sky

Grades 5–8

- Earth in the solar system