

## **The Sun, the Earth and the Moon: Young Students' Grappling with an Illustration of the Lunar Phases**

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### ***Introduction***

The Swedish national curriculum states that the children already from the earliest school years shall be taught about the movements of the earth, the sun and the moon in relation to each other, as well as about the phases of the moon. However, from a substantial body of international research, it is well documented that the moon phases is a phenomenon difficult to explain not only for children but also for adults (see, e.g., Baxter, 1989; Martinez Pea & Gil Quilez, 2001; Schoon, 1992; Subramaniam and Padalkar, 2009)

### ***Research questions***

The present study deals with primary students' making sense of an illustration showing the sun, the earth and the moon drawn as semi-filled circles at four positions in the lunar orbit, read together with an accompanying text. Three specific research questions are focused on in the presentation:

- Which central features of the illustration do the students identify?
- Are the students able to point out the new and full moon phases in the lunar orbit with point of departure in the provided information?
- Are there indications of the students' adopting necessary perspectives and if not what are the consequences?

### ***Methodology***

In the data collection for the research presented in this paper ten pairs of pupils 9 to 12 years of age from two primary classes participated. The activity was formed as a multimodal practice guided by the first author. One pair at a time was asked to read two double pages from a small booklet about the moon. Having finished this reading, they were asked to tell about the particular illustration described above. Next, a series of eight moon phases, from the new moon through the small waning crescent, drawn on a separate sheet and numbered in sequence, was presented to the students and discussed. Thereafter, their task was to place the eight numbers at the right place in the lunar orbit. During this phase the focus was on the new and full moon in particular.

The main method for documenting the data was video recordings in addition to complementary field notes. Two cameras were used; one catching the interpersonal interaction between the students and one zooming in on the interpreted illustration. Relevant parts of the video recordings were transcribed verbatim and with relevant situational aspects included. Field notes were written down as soon after the observed sessions as possible. In addition, the students' solutions to the moon-phase task were collected and kept for the analysis.

The analysis was conducted with point of departure in the research questions above. In addition, Engebretsen's (2012) approach to the study of semiotic complexity, and Carney and Levin's (2002), five functions of images in relation to educational texts.

### ***Findings and conclusions***

A majority of the students identified the most central features of the illustration; the sun, the earth, the moon and the lunar orbit; even though some needed a hint to understand that the sun was part of one and the same picture, due to an unfortunate design of this particular illustration. There were three ways in which the students approached the task to point out the position for the moon in the lunar orbit at the time for the new and full moon phases. One builds upon the common misunderstanding that the phases of the moon are caused by an eclipse of the moon by the earth and another on students' own experiences of the phases of the moon. A third way was to make interpretations more closely related to the illustration, but only one group did it in the intended way.

It is evident that at least two perspectives must be adopted at the same time in order to make reasonable sense of the illustration. To understand the shading of the four circles at the four positions in the lunar orbit one needs to adopt an 'above-the-ecliptic' perspective, whereas to correctly point out the positions of the phases of the moon one must be able to take a 'standing-on-earth perspective', as well, or rather a perspective from 'standing on the northern hemisphere of the earth'. Only one group of students managed to handle these two perspectives without help from the researcher, while one other group seemed to do so after the researcher's help. Considering our results, it may be questioned if this commonly used illustration should be presented at all to students as young as those in this study.

### ***References and other relevant literature***

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