

The pre-service teachers understanding about moon phase

N Saenpuk¹ and C Ruangsuwan²

¹Faculty of Education, Khon Kaen University, Khon Kaen, Thailand.

²Faculty of Science, Khon Kaen University, Khon Kaen, Thailand.

E-mail: s.nudchanard@kkumail.com

Abstract. Interactions in the Sun-Earth-Moon System are common misconception for students. Pre-service teacher should develop the lesson plans about the Sun-Earth-Moon system for their professional experience in school. In this work, we investigated understanding of 26 pre-service teachers in the topic of Sun-Earth-Moon system, emphasize on moon phase concept. They studied the earth science, astronomy and space concept learning management course in the first semester of academic year 2016 (August to December 2016). An open-ended question about cause of moon phase is mainly used as research tool. Their responses had been interpreted and categorized into level of understanding by considering key-words, such as, the earth, the moon and the sun. The result revealed that most pre-service teachers have suitable concepts but not all of the components and some of them contain misconception. The finding would be brought into the course for designing lesson plan and tools for improve concept about the moon phase.

1. Introduction

Moon phase can be observed elsewhere in the earth and is related to the daily life. It was placed in science content in the Thai's national curriculum. It was being taught in the secondary school and the aim of standards and indicators in curriculum require students can explain the relationships between Sun, Earth and Moon. For example, the relationships between Sun, Earth and Moon cause the moon phase, tide etc. Moon phase is the one of basic astronomical phenomena. In addition, phase of the moon is one of the most common misconceptions. Misconception may be caused by multiple related concepts, informal daily life experiences, instruction and process of concept construction. Teacher is one of the important factors for concept construction. If teacher's conceptions are diverging from scientific concept, it may be very difficult to teach a correct concept to the students. The aim of the course is that the students can explain phenomena and understanding the moon phases.

In 1999, Stahly et al. [1] found that children in primary school and high school have many misconceptions about cause of moon phase;

- “1. Clouds cover the part of the moon that we cannot see
2. Planets cast shadows on the part of the moon that we cannot see
3. The shadow of the sun falls on the moon, blocking our view of it all
4. The shadow of the earth falls on the moon, blocking our view
5. The phases are explained in terms of the portion of the illuminated side of the moon visible from the earth.”

In 2002, Trundle K. C. [2] revealed that pre-service elementary teacher' held conceptual understandings conceptions about moon phases. The result show that most pre-service teachers held

alternative conceptions on the cause of moon phases; most often attributed to the earth's shadow. Yalcin F. A. (2012) [3] found that pre-service teacher hold common misunderstandings about moon's phases and lunar eclipses. Most students believe the main reason is earth' shadow, the sun sends the rays to moon in varied angles.

So the earth science, astronomy and space concept learning management course is designed to improve pre-service teacher's understanding in the topic of basic astronomy. The cause of moon phase is one of the topics. Teacher investigated student understanding in each topic, the results found from this studied bring to pre-service teacher to design lesson plan and tools for improve concept in course

2. Methodology

This aim of this research is to investigate the understanding of 26 pre-service teachers about moon phase during they are studying the earth science, astronomy and space concept learning management course. The open-ended questions were used for measuring their understanding in related concepts and then interpreted by considering to astronomical keywords.

2.1. Target group

The target group of this study is 26 (3rd-4th year) pre-service teachers studying in science education, Khon Kaen University. And participate are 26 students in the first semester of 2016 academic year in the earth science, astronomy and space concept learning management course.

2.2. Methods of Inquiry

Method of data collection is qualitative research. In this research we used 3 open-ended questions, and modify question based on the suggestions of science teacher expert.

2.3. Data analysis

The students' responses were interpreted and categorized into level of understanding and considering to key-word; the earth, the moon and the sun. The technique of rubric that used in this research was developed by Abraham, Williamsom, and Wetsbrook (1994) [4], as following criteria (Table 1)

Table 1 Criterion Used in the Evaluation of the Open-Ended Questions

Understanding Level	Aspect
Sound Understanding (SU)	Answer shows all aspect of valid or scientifically accepted.
Partial Understanding (PU)	Answer show some aspect of valid or scientifically accepted but not all the components
Partial Understanding with Specific Misconception (PU+SM)	Answer included both incorrect information and correct information
Specific Misconceptions (SM)	Scientifically incorrect answer, answer show incorrect information or illogical
No Understanding (NU)	Irrelevant answer, blank, repeats question, etc.

3. Research Findings

The answers of pre-service teachers were classified by keyword in Table 2. They used various keywords to explain this concept.

It was found that 18 students (69.23%) used relationships between the earth and the moon to explain about cause of moon phases. For example, the moon orbit around the earth is the cause of shadows of the earth on part of the moon.

There were 11.50% or 3 students using relationships between the earth, the sun and the moon to explain the moon phases phenomenal. For example, the moon orbits the earth and the angle between Sun, Earth and Moon cause of observe difference bright shape of the moon in each position.

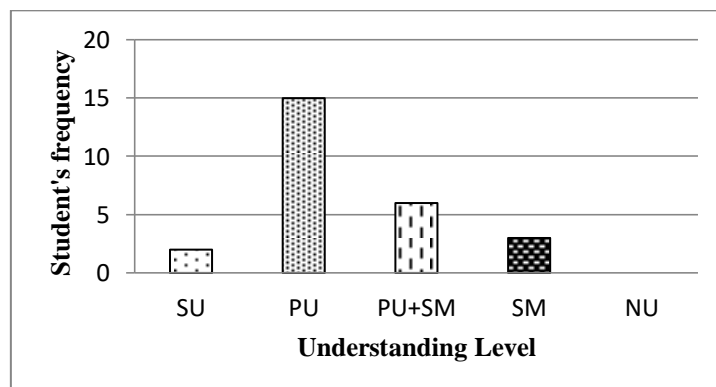
There were 2 students or 7.69% using the sun to explain phenomena. The other students used the sun and the moon, the moon and the earth to describe the concept. And 1 student used the moon to explain it. Moreover, they answer can be marshaling level of understanding from answer and the result shows in Graph 1.

Table 2 Students keyword about causes of the moon phases

Keys-word of student answer	Number of student (%)
The earth, the sun and the moon	3 (11.50%)
The earth and the sun	1 (3.85%)
The sun and the moon	1 (3.85%)
The moon and the earth	18 (69.23%)
Only the moon	1 (3.85%)
Only the earth	- (0.00%)
Only the sun	2 (7.69%)

The findings from open-ended questions were represented in Graph 1 below.

Graph 1 Student's frequency and students' level of understanding in cause of moon phases.



Graph 1 shows the number of student with different understanding level. Most of students were classified at the partial understanding level. Only 2 Students answered at the sound understanding level. The remaining answer were classified as partial understanding with specific misconception level (6 students) and specific misconceptions level (3 students)

Most students in partial understanding level provided the following some aspects of valid or scientifically accepted about cause of moon phase:

“The moon orbits about the earth”

“The position of Moon change around the earth”

“The moon orbits the Earth and that the Earth orbits the Sun”

“The moon orbits the earth together with Earth's rotation”

Some students' answer reveals all aspect of valid or scientifically accepted in the understanding level:

“The moon orbits the earth and the angle between Sun, Earth and Moon cause of observe difference bright shape of the moon in each position.”

However, as shown in Graph 1, partial students' answers contained both incorrect information and correct information in the partial understanding with specific misconception level. But specific

misconception use classified student's response is incorrect answer. Some student's answer in PS + SM level included:

"The position of Moon change around the earth. The Earth's shadow falls on the moon and causes the phase"

"The moon orbits about the earth caused it had difference area shined by sunlight each day."

And "The moon orbits around the earth and earth shield part of sunlight to the moon that we see the bright part or phase of the moon."

There are 2 students in specific misconceptions (SM) level; student's answers are as follows:

"The Sun, Moon and Earth are stand in a row. And the shadow of the earth falls on the moon"

"Shadows of the earth falls on part of the moon cause of shadow were making light to the earth."

4. Conclusion

The results revealed that the pre-service teacher had misconceptions in astronomy as in the previous research (Trundle & el al., 2002; Yalcin & el al., 2012). Only a few people had scientific understanding; they could completely explain the given phenomena. However, the most pre-service teachers are categorized in partial understanding level. The finding will be used to design the lesson plans in the course.

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