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The Understanding of Undergraduate Physics Students Regarding the Super Blood Moon Total Lunar Eclipse Phenomenon May 26, 2021

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Abstract. Wednesday, May 26, 2021, a total lunar eclipse phenomenon known as the Super Blood Moon occurred in almost all parts of Indonesia. The community gives various perceptions about this phenomenon. Therefore, a more in-depth research is needed. This study aims to determine and analyse the level of understanding of physics students at the Universitas Negeri Surabaya regarding the phenomenon of the Super Blood Moon Total Lunar Eclipse and to determine the level of knowledge of physics undergraduate students regarding the differences in the wonders of Supermoon, Super Blood Moon and Super Blue Blood Moon. This research was conducted using qualitative methods. This study involved twenty-five students majoring in physics at the Universitas Negeri Surabaya using an online questionnaire. Respondent's opinion from the questionnaire was then grouped into four levels of conditions adapted from Posner et al., the four levels of conditions were Dissatisfaction, Intelligible, Plausibility, and Fruitfulness. The results showed that undergraduate physics students' understanding of the lunar eclipse phenomenon was at the level of dissatisfaction while understanding the differences in the wonders of Supermoon, Super Blood Moon, and Super Blue Blood Moon was at the level of Plausibility.

1. Introduction

Wednesday, May 26, 2021, a total lunar eclipse phenomenon known as the Super Blood Moon occurred in almost all parts of Indonesia [1]. Total Lunar Eclipse this time is very special because it coincides with perigee, a condition where the moon is at its closest distance to the Earth. In addition, at this Total Lunar Eclipse, the moon appears red due to the refraction of sunlight by the Earth's atmosphere. Therefore, this Total Lunar Eclipse is also called a Super Blood Moon [2]. A *lunar eclipse* is a natural phenomenon that occurs when the moon passes through the Earth's shadow. There are several types of terms from the moon, including Super moon, blue moon, and blood moon. A supermoon occurs when the moon is at perigee or its closest point to the Earth. Blue moon refers to the phenomenon of the full moon that occurs twice in one month. At the same time, a blood moon is a condition when the moon looks red because of the refraction of sunlight by the Earth's atmosphere [3-4].

There can be several phenomena in a single lunar eclipse, such as the Super Blood Moon and Super Blue Blood Moon phenomena. Super Blood Moon is a combination of the Supermoon and Bloodmoon phenomena. Therefore, in the Super Blood Moon phenomenon, the moon is at the closest point to the



Earth so that it looks bigger and looks reddish due to the refraction of sunlight by the Earth's atmosphere. At the same time, the Super Blue Blood Moon is a combination of the phenomena of Super moon, blue moon, and blood moon. Almost the same as the Super Blood Moon phenomenon, only the Super Blue Blood Moon phenomenon occurs when the lunar eclipse that arises is the second full moon in one month [5-8].

In contrast to previous studies that discussed supermoon lunar eclipses, penumbral lunar eclipses, and strawberry lunar eclipses [9-13], this study examines the Super Blood Moon Total Lunar Eclipse. Then, the supermoon lunar eclipse research subject is pre-service physics teachers, while in this study, the issue is physics undergraduate student. In addition, research on the understanding of undergraduate physics students regarding the Super Blood Moon Total Lunar Eclipse phenomenon has also never been carried out. Therefore, a more in-depth study is significant to do.

Responding to this natural phenomenon, as physics researchers, we caught a different perception from physics students regarding the Super Blood Moon Total Lunar Eclipse. As an undergraduate physics student, it is essential to understand natural phenomena such as lunar eclipses and explain them scientifically. They have also acquired knowledge of astronomical phenomena from elementary school to university level. This study aims to determine and analyze the level of understanding of physics students at a public university in Surabaya Indonesia regarding the phenomenon of the Super Blood Moon Total Lunar Eclipse and to determine the level of knowledge of physics students regarding the differences in the wonders of Supermoon, Super Blood Moon and Super Blue Blood Moon.

2. Method

This study involved 25 respondents of students majoring in physics, from a public university in Surabaya, Indonesia. Respondents' names will be disguised and referred to by popular Indonesian nicknames, for example, Yusril (Ys), Ajeng (Aj), Mila (Ml), Sri (Sr), Ismi (Is), and others. This research utilised a qualitative method. The method is used to understand the process of constructing meaning well [14-15]. There are eight questions related to the Super Blood Moon Total Lunar Eclipse phenomenon on May 26, 2021. The research data from the questionnaire were then transcribed, analysed, and grouped into four levels of conditions adapted from Posner et al. [16]. According to Posner et al., the four levels of the condition are Dissatisfaction, Intelligible, Plausibility, and Fruitfulness. The dissatisfaction condition is when students begin to doubt the original concept. Therefore, there must be dissatisfaction with existing conceptions, while the Intelligible state is where students can find the idea and can be understood. The condition of Plausibility is where students have found coherent and reasonable arguments. The Fruitfulness state is one in which students discovering new ideas must ascertain the possible use of research. A new concept should suggest the possibility of a fruitful research program [16].

3. Result and Discussion

Based on the research data, the results of the percentage level of respondents' knowledge regarding the phenomenon of the Super Blood Moon total lunar eclipse on May 26, 2021. The results obtained can be seen in figure one below.

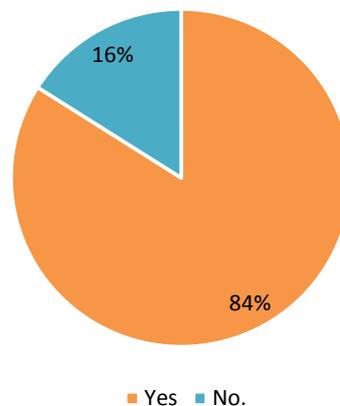


Figure 1. Percentage of respondent's level of knowledge related to the phenomenon of the Super Blood Moon Total Lunar Eclipse May 26, 2021

Based on the figure 1 percentage above, it can be seen that most of the respondents know that on May 26, 2021, the Total Super Blood Moon Eclipse will occur. Physics students gave a different explanation regarding the lunar eclipse phenomenon. The respondents' answers interpreted the level of understanding of physics students regarding the phenomenon of lunar eclipses. Most of their reasons are at the level of dissatisfaction. The following is an explanation of respondents who are at the level of dissatisfaction:

"A lunar eclipse occurs when the moon passes through Earth's shadow." [Ek]

"A lunar eclipse occurs when the earth partially covers the surface of the moon." [Ts]

"A lunar eclipse causes the sky to darken, making it easier to see starlight." [Ad]

"Lunar eclipses are associated with non-scientific activities such as it is recommended to take a bath during a lunar eclipse with the reason that they do not get old too quickly, pregnant women are advised to carry out "ngliwet", this is believed to be aimed at preventing babies from being born with defects." [Sr]

"During a total lunar eclipse, Balinese people are usually greeted differently. Every resident held a ceremony and beat the gong when the lunar eclipse began to occur until it reappeared. This activity is carried out by the Hindu community in Bali every time a total lunar eclipse occurs. In mythology, it is referred to as the "Bulan Kepangan"." [Sy]

At this level, respondents did not clearly explain the lunar eclipse phenomenon, and the answer was incorrect. The scientific and non-scientific activities described are also related to mystical beliefs in several Indonesian regions. The second level is the Intelligible level. At this level, the answers given by physics students are still less precise but better than the answers in the last category. The following is the explanation given by the respondents:

"A lunar eclipse occurs when Earth's shadow covers part or all of the Moon." [Hn]

"When the sun's position, earth and moon are in a straight line so that the shadow of the earth covers all or part of the moon's surface, a lunar eclipse only occurs at night." [Nr]

"A lunar eclipse affects the earth, which experiences a night phase for a while." [Nr]

"The impact of a lunar eclipse is that there are high tides and extreme temperature changes." [Uz]

"I can't see the lunar eclipse directly" [Ts]

The third level is the level of Plausibility. At this level, the opinions or explanations of undergraduate physics students regarding the lunar eclipse phenomenon have improved but are not perfect. According to Posner et al., this level can be reached when the respondent can explain a reasonable concept and know exactly about the idea. Following are the opinions given by respondents:

“A lunar eclipse occurs when the sun, earth and moon are in straight line so that the earth's shadow covers part of the moon.” [Al]

“A lunar eclipse occurs when the Earth's shadow covers part or all of the moon's cross-section in a straight line.” [Nb]

“The lunar eclipse impacts rising sea levels due to the moon's gravity so that the sea tides.” [Nb]

“When there is a lunar eclipse, scientific activity is that researchers and astronomers will prepare to conduct research related to this lunar eclipse.” [Is]

“When a lunar eclipse occurs, scientific activity occurs to observe and study the phenomenon of a total lunar eclipse. The eye can follow this lunar eclipse, and there is no need to use the help of special optical instruments.” [Dh]

Based on the opinion given above, it can be seen that physics students understand the causes, impacts, scientific and non-scientific activities of the lunar eclipse phenomenon and can provide valuable concepts. The next level is the Fruitfulness level, and the following are the opinions given by the respondents:

“A lunar eclipse occurs when the sun, earth and moon are in straight line so that the earth's shadow covers part or all of the moon.” [Ml]

“A total lunar eclipse will occur when the moon's position is correct in the umbra area or the earth's dark shadow.” [Sy]

“A lunar eclipse can cause sea levels to rise due to the moon's gravity, resulting in high tides. If the lunar eclipse occurs in total, this tidal phenomenon will last for the next three days with strong waves, which can even cause flooding.” [Aj]

“A total lunar eclipse will create an unusual tidal flood. This extra high tide of the Supermoon can cause flooding when coupled with extreme weather when the water on the coast is very high tide.” [Dh]

“Scientific activity during a lunar eclipse is that many researchers carry out actions using tools to monitor events in detail the process of a lunar eclipse so that the results of their research can be developed into science related to natural events. Usually, this is investigated whether there is a correlation between the occurrence of lunar eclipses and disasters that have occurred or even has not happened.” [Sr]

Next is to identify and analyse the level of understanding of physics students regarding the differences in Supermoon, Super Blood Moon, and Super Blue Blood Moon. Respondents' opinions are classified into four-level categories. The first level is the level of dissatisfaction. Here are some explanations of physics students belonging to the first level.

“Supermoon, the moon looks brighter than usual. Super blood moon, the moon looks orange to red as blood. Super blue blood moon, the moon appears blue.” [Uz]

“A supermoon is a full moon, a super blood moon is a full reddish moon, and a super blue blood moon is a total lunar eclipse.” [Al]

“Supermoon looks closer and looks very bright. Super blood moon, the colour of the moon that tends to be reddish during an eclipse. Super blue blood moon, I don't know.” [Ek]

At this level, respondents did not explain the differences in Supermoon, Super Blood Moon, and Super Blue Blood Moon clearly, and the answers were inaccurate. The second level is the intelligible level. Here are some explanations of physics students who fall into the category of intelligible level.

“A super moon is when the Moon will be 30 per cent brighter and 14 per cent larger than usual. It coincides with perigee, which is the Moon's closest point to the Earth in its monthly orbit. Super Blue Moon is when the Moon appears bluish. A super blood moon occurs when the Earth passes between the Moon and the Sun. As a result, the Moon has a reddish/blood-like colour when viewed from Earth.” [Ml]

“Super moon is a phenomenon where the moon is in its closest position to the earth to look very large. A super blood moon is the same as a super moon, except that the moon looks red. If you're a super blue blood moon, you don't know the difference.” [Nn]

At this level, the respondent can provide a clear explanation, the answer regarding the Supermoon phenomenon is correct, but the reason regarding the Super Blood Moon and Super Blue Blood Moon is still inaccurate, the respondent assumes that the cause of the Super Blood Moon and Super Blue Blood Moon phenomena is because the moon is coloured red or blue. The next level is the level of Plausibility. Most of the opinions of physics students are at this level. Here are some explanations of physics students who fall into the Plausibility level category.

“Supermoon, the moon is at the closest position to the earth, so it looks bigger. Super blood moon, the moon is at the closest position to the earth so that it seems bigger and red due to the angle of refraction of the sun's penumbra light. Super blue blood moon, same as the super blood moon, the difference is blue due to the rise of refraction of the sun's penumbra light that is different from super blood moon.” [Ys]

“A supermoon is when the moon looks more prominent than usual. Super blood moon is when a total lunar eclipse, the moon's colour looks reddish-orange, almost resembling blood. Super blue blood moon is a combination of the blue moon, blood moon, and supermoon.” [Nb]

“Super moon is when the moon is at its closest position to the earth so that it looks more prominent, a super blood moon is a total lunar eclipse event where the moon looks red like blood, super blue blood moon is a lunar eclipse event that occurs a combination of the blue moon, blood moon and super moon.” [Sr]

At this level, the explanation given by physics students has improved but is still not perfect. There are still some answers that explain that the Super Blood Moon or Super Blue Blood Moon phenomenon is caused by the colour of the moon seen from the earth. The fourth level is the Fruitfulness level. Here are some explanations of physics students who are included in the Fruitfulness level category.

“A supermoon is a phenomenon that occurs when the Moon is at its closest point to Earth, where the Moon will be 30 per cent brighter and 14 per cent larger than usual. Super Blood Moon is when the Moon is in the Earth's umbra during the peak of a lunar eclipse and causes the Moon to appear red. It means that the Sun, Earth, and Moon positions are parallel in a straight line. In addition to being red at the peak of the total eclipse, the Moon will also appear more prominent. It happens because the location of the Moon is very close to Earth. Super Blue Blood Moon is a natural phenomenon where the event combines three lunar phenomena at once where a total lunar eclipse occurs when the Moon is at its closest point from the Earth and appears on the second full Moon in one month.” [Sf]

“Supermoon, because the Moon will be at its closest distance to Earth (perigee), so it appears 14% larger and 30% brighter than usual. It is called Super Blood Moon because it is a combination of Supermoon and blood moon. It is called the super blue blood moon because it combines three lunar phenomena at once, namely Supermoon, Blue Moon, and blood moon. It happens because the Moon's orbit is relatively close to the Earth.” [Dh]

“A supermoon is a phenomenon that occurs when the Moon is at its closest point to Earth. Super Blood Moon or red Moon is a term to refer to the sensation of a Total Lunar Eclipse. The Super Blue Blood Moon is a combination of three different phases of a lunar eclipse. Three lunar eclipse phenomena co-occur, ranging from Blue Moon, Blood Moon, to Supermoon.” [Aj]

At this level, the reason given by undergraduate physics students has reached perfect in the answer about Supermoon. Even explaining the Super Blue Blood Moon phenomenon is appropriate, but a more detailed description of this phenomenon is still needed. As for the Super Blood Moon phenomenon, some physics students think that this is because the moon looks red. Therefore, based on the explanation above, it can be seen that physics students are less familiar with the Super Blood Moon and Super Blue Blood Moon phenomena.

Super Blood Moon is a combination of the Supermoon and Bloodmoon phenomena. Therefore, in the Super Blood Moon phenomenon, the moon is at the closest point to the earth so that it looks bigger and looks reddish due to the refraction of sunlight by the earth's atmosphere. At the same time, the Super Blue Blood Moon is a combination of the phenomena of Supermoon, Blue moon, and

Bloodmoon. Almost the same as the Super Blood Moon phenomenon, only the Super Blue Blood Moon phenomenon occurs when the lunar eclipse that arises is the second full moon in one month [5-8].

Based on the analysis above, it can be seen that the understanding of physics students regarding the lunar eclipse phenomenon is at the level of dissatisfaction, while the knowledge related to the differences in the wonders of Supermoon, Super Blood Moon, and Super Blue Blood Moon is at the level of Plausibility. This is in line with research conducted by Deta et al. and Suprpto et al. [9-10], which stated that the level of understanding of undergraduate physics students regarding the lunar eclipse phenomenon was at the level of dissatisfaction.

Based on the opinions given by undergraduate physics students, it is known that undergraduate physics students still do not understand the phenomenon of lunar eclipses. Therefore, science process skills are needed to improve the conceptual understanding of physics students and can help solve problems more accurately. In addition, higher-order thinking skills with the scientific method also need to be improved. This allows someone to explain things correctly based on what they see. In addition, some phenomena cannot be explained only by opinion but must also be supported by scientific evidence. For this reason, science process skills are necessary and essential to be applied in everyday life [17-19].

4. Conclusion

Based on the research that has been done, it can be concluded that the understanding of physics students regarding the lunar eclipse phenomenon is at the level of dissatisfaction, while the knowledge related to the differences in the wonders of Supermoon, Super Blood Moon, and Super Blue Blood Moon is at the level of Plausibility. Therefore, it is recommended for physics students to improve their understanding of natural phenomena such as the lunar eclipse phenomenon by improving their scientific process skills.

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