The scientific argumentation profile of annular solar eclipse phenomenon June 21st 2020 of physics undergraduate student in Universitas Negeri Surabaya

Utama Alan Deta1*, Vivin Khoiri Yanti1, Misbah2, Saiyidah Mahtahari2, and Alamsyah3

1 Department of Physics, Universitas Negeri Surabaya, Indonesia
2 Physics Education Study Program, Universitas Lambung Mangkurat, Banjarmasin, Indonesia
3 Universitas Islam Negeri Raden Intan, Lampung, Indonesia

*Corresponding author: utamadeta@unesa.ac.id

Abstract. Arguments play an important role in determining how strong an understanding of science is. Training and increasing the level of student argumentation can be done in various ways, including by teaching students to argue about natural phenomena around such as the phenomenon of an annular solar eclipse. On Sunday, June 21, 2020, there will be an annular solar eclipse that will pass across parts of Indonesia. In responding to this phenomenon, the perception of the people or citizens of Indonesia is very diverse. Therefore, further research is needed. This research aims to describe and analyze the comprehension and scientific argumentation profile of Annular Solar Eclipse Phenomenon June 21st 2020 of Physics Undergraduate Student in Universitas Negeri Surabaya. This research was conducted with a descriptive qualitative research method and the data analyzed by using an observer rubric adapted of Toulmin’s argumentation pattern. Seventy respondents Physics Undergraduate Student, class of 2017, from Universitas Negeri Surabaya were involved in this study using a questionnaire and interview. The result showed that physics students had a fairly good knowledge and understanding related to the phenomenon of the annular solar eclipse, meanwhile, the subject’s ability in providing scientific argument is at the level of providing claims and evidence, but weak warrant. Subjects will not be able to explain their scientific arguments if they are not supported by the knowledge they have. Therefore, it can be recommended that physics students can improve their understanding of the concept of an annular solar eclipse through a process of argumentation.

1. Introduction

Sunday, June 21, 2020 an annular solar eclipse phenomenon occurred which crossed 432 cities and regencies in 31 provinces in Indonesia [1]. Solar eclipses occur when the earth, moon and sun are in a straight line with the moon between the earth and the sun. The position of the moon causes sunlight radiating to the earth to be blocked by the moon so that parts of the earth affected by the shadow of the moon (umbra) will experience a solar eclipse. When the moon circle only covers the middle of the sun circle, causing observers on earth in the atumbra region will see the sun ring where this
phenomenon is called the Annular Solar Eclipse. Annular of the Sun eclipse occurs when the moon is at its farthest point from the earth [2-4]. Arguments are one of the basic steps for implementing students' critical thinking processes and scientific literature [5]. Argumentation is a process that can be used to analyze information with a topic which is then communicated to others. Arguments play an important role in determining how strong an understanding of science is [6-8]. Argumentation is also used as a process of thinking and social interaction where one can build and criticize an argument [9-10]. Thus, arguments in learning science are part of the development of higher order thinking skills [11-12].

From research conducted by Yuli Andriani and Riandi [13] shows that student involvement in preparing scientific arguments is very influential in laboratory activities. However, from this research only carried out in written form, whereas in this study, the subject's argumentation skills were learned verbally and in writing. This is also in line with research conducted by Oktapriyadi Syaiful and Muslim [14] as well as by Gabriela Azizah and Setyo Admoko [15] which show that problem-based learning and discussion learning have a strong influence on students' ability to argue scientifically. Therefore, practising students' scientific argumentation skills can be done by analyzing problems or natural phenomena around such as an annular solar eclipse. Also, research examining the level of scientific argumentation on the phenomenon of annular solar eclipses has never been done.

An annular solar eclipse is an extraordinary science phenomenon that is quite rare. Therefore, researchers flocked to examine this phenomenon every time an annular solar ring eclipse occurs. As a physics student, it's undoubtedly essential to be able to understand space phenomena such as solar eclipses. Physics students have also studied astronomy and eclipses since elementary school and explored through earth and space science at universities. Public perceptions and knowledge related to this phenomenon are also very diverse [16]. As educators, the research team will contribute to increasing general understanding of the phenomenon of solar eclipse through scientific argumentation. Therefore, this research was conduct to describe and analyze the comprehension and scientific argumentation profile of the Annular Solar Eclipse Phenomenon June 21st 2020 of Physics Undergraduate Student in Universitas Negeri Surabaya.

2. Method
This research was conducted with a qualitative descriptive method. This research was conducted involving 70 respondents of physics students from the 2017 class at Universitas Negeri Surabaya, consisting of 13 male students and 57 female students to be the focus of this study. Respondents came from a combination of physics education program students and non-educational physics study programs with a comparison of 68 physics education students and 12 non-educational physics students. Respondents are referred to by popular pseudonyms in Indonesia, namely Ajeng (Aj), Melly (Ml), Ella (El), Faris (Fr), Sekar (Sk), etc.

Data collection was collected using a questionnaire to find out scientific arguments and supported by asking questions in oral form (oral scientific arguments). There is 4 research question related to the topic about annular solar eclipse in the questionnare. Oral scientific arguments are made online. Qualitative methods are used to understand the process of constructing meaning well [17]. The data analysis technique that used in this research is qualitative descriptive analysis technique. The data that from questionnare or interview had been transcribed and than analyzed by using an observer rubric adapted of Toulmin [18]. The data had been categorized into the level of argumentation adapted from Toulmin’s argumentation pattern based on table 1.

| Level | Criteria |
|-------|----------|
| 1     | a. The argument is very weak  |
|       | b. The claim is invalid and the data is not reliable |
|       | c. The relationship between the claims, data, warrant very weak |
| Level | Criteria |
|-------|----------|
| 2     | d. The relationship between the components no argument |
|       | a. The argument is quite good |
|       | b. Claims inadequate and insufficient data good |
|       | c. The relationship between claims and evidence good enough |
|       | d. The relationship between the components is sufficient argument |
| 3     | a. Strong argument |
|       | b. The claim is valid, the data is strong and well warrant |
|       | c. The relationship between claims and evidence |
|       | d. Relationships between components are strong arguments |
| 4     | a. The argument is very strong |
|       | b. Very valid claim, the data to clarify the claims, include a strong evidence |
|       | c. The relationship between the claim and the evidence is very strong |
|       | d. The relationship between the components very strong argument |

3. **Result and Discussion**

Based on the responses of respondents, obtained a percentage of Student Knowledge Presentations Related to the Annular Solar Eclipse on June 21, 2020. The following result are obtained,

![Figure 1. Graph of The Comprehension Physics Undergraduate Student of Annular Solar Eclipse Phenomenon June 21st 2020](image)

Based on the graph above, most respondents were aware of an annular solar eclipse on June 21, 2020 but did not observe directly. Interviews are therefore needed in order to find out the reasons of respondents in more detail. Respondents' reasons are given in the following statements:

“To be able to directly observe the solar eclipse requires special glasses, because at that time I was not carrying glasses, so I could not see the annular solar eclipse at that time.” [Sk]

“I know that there will be a solar eclipse from the news and social media, but when an annular solar eclipse occurs, I am busy with other activities so that I cannot observe directly.” [Rz]

“At the time the sun eclipse was announced I would be ready to observe, but where I was there was no change in the sky (no eclipse occurred) so I could not observe the solar eclipse directly.” [Ns]

“In the previous solar eclipse, I had observed directly, but I could not see anything because I did not wear special glasses, therefore in the solar eclipse this time I did not observe because it would not appear too.” [Aj]
“I am interested in being able to observe annular solar eclipses directly, but because it has some busyness so I cannot observe annular solar eclipses directly.” [Ln]

Based on the explanation of the subject, it can be seen that most of the subjects know the occurrence of an annular solar eclipse and public access understand that a solar eclipse will occur relatively easy to reach by the community. But, due to specific reasons such as having some busyness and not having special glasses to observe the eclipse, respondents cannot attend the occurrence of an annular solar eclipse directly. This is in line with a study conducted by Suprapto [16], which showed that pre-service physics teachers performed deep understanding and knowledge of the lunar eclipse phenomenon.

Based on the results of the questionnaire by Physics Undergraduate Student related to the scientific argumentation profile about Annular Solar Eclipse Phenomenon June 21st 2020, the following results are obtained.

Based on the graph of the relation between questions and the level of argumentation show that argumentation by physics undergraduate student is at the range 3 from 3 research questions related to the topic about annular solar eclipse. The subject can answer the question well according to indicators of scientific argumentation. The subject gives a claim and strong argument, but many subjects are still lacking in providing justification / explanation based on relevant evidence and theory. This is in line with research conducted by Utama Alan Deta et al. [19] which showed that argumentation by non-science undergraduate students is at the range level 3 and the subject's ability in providing scientific argument is at the level of giving claims with the support well warrant.

Based on the data obtained, question 3 produce a mean score at level 2. This is due to the lack of understanding by students in university about annular solar eclipse. Question number 3 regarding the cause of an annular solar eclipse.

In number 3 with question “Explain the cause of an annular solar eclipse!”. Based on the data findings, there is the different opinion about annular solar eclipse among physics undergraduate student. The average subject give an opinions is right, but not enough strong argument and some subjects are still weak warrant/explanation in accordance with relevant theory. The following are examples of subject' explanation:

“An annular solar eclipse occurs when the moon is not large enough to cover the entire sun.” [Er]

“The reason is when the sun, moon and earth are in a straight line but the size of the moon is smaller than the sun so this causes an annular solar eclipse.” [Me]
Correct answer to the cause of an annular solar eclipse is because the earth, moon, and sun are in a straight line with the moon between the earth and the sun, the position of the earth is the closest point to the sun, while the position of the moon is at the farthest point from the earth. The position of the moon causes sunlight that radiates to the earth to be blocked by the moon with the moon circle only covering the middle of the sun's sphere, causing observers on the earth in the atumbra area to see the sun ring / can see the annular solar eclipse. But the average of subject's answer that anular solar eclipse is due to the smaller size of the moon than the size of the sun. In this question, obtained justification / explanation that the size of the moon is always constant so that if there is a total solar eclipse, a ring solar eclipse, or a partial solar eclipse, it is not due to the difference in the diameter of the moon, when an eclipse occurs, the size of the moon only looks the same or slightly smaller than the size of the sun when seen by observers on earth.

Based on research conducted by Roviati et al with the title Perceptions of Prospective Biology Teachers on Scientific Argumentation in Microbiology Inquiry Lab Activities, show the results that the subjects showed low quality of argumentation skills [20-23]. But, this research show that the subject’s ability in providing scientific argument is at the level of providing claims and evidence, but weak warrant.

Training and increasing the level of student argumentation can be done in various ways, including by teaching students to argue about natural phenomena around such as the phenomenon of an annular solar eclipse. Students will not be able to explain their scientific arguments if they are not supported by the knowledge they have. Therefore, it can be recommended that physics undergraduate students can improve their understanding of the concept of an annular solar eclipse through a process of argumentation.

4. Conclusions
Based on research that has been done, the results show that physics undergraduate students have a fairly good knowledge and understanding related to the phenomena of annular solar eclipses, meanwhile, the subject’s ability in providing scientific argument is at the level of providing claims and evidence, but weak warrant. Subjects will not be able to explain their scientific arguments if they are not supported by the knowledge they have. Therefore, it can be recommended that physics students can improve their understanding of the concept of an annular solar eclipse through a process of argumentation.

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