

## STUDENTS PERCEPTION OF AUGMENTED REALITY LEARNING MEDIA ON SOLAR SYSTEM TOPICS

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**Abstract:** The purpose of this study was to describe students' perceptions of augmented reality learning media in solar system topics. The type of research used was descriptive research. The participants involved in this study were 32 students from class 8C of State Junior High School 3 Sidoarjo, Indonesia. The instruments used consist of a student perception questionnaire and an interview. The questionnaire has been validated previously and consists of 5 questions about the concept of planets and the concept of the moon concerning augmented reality learning media. The results showed indicators 1, 4, and 6 obtained the highest score of 97%. It means that students can easily understand these indicators using augmented reality. Indicator 2 got the lowest result of 72%, meaning that students have little difficulty understanding the indicator using augmented reality but are still in the good category. As many as 87% of students rated that augmented reality learning media is very helpful in understanding the material of the solar system. Data from interviews with six students also support this result. They stated that augmented reality is the most effective learning media in studying solar system topics because students considered it more transparent, more interesting, more comfortable to use, and more accessible for students to understand. In conclusion, augmented reality learning media has proven to be effectively used in learning solar system topics. It also can be applied to other abstract science topics that are difficult for students to find in everyday life.

**Keywords:** *Perception, Learning Media, Solar System, Augmented Reality*

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### INTRODUCTION

Natural science is one of the compulsory subjects in high school. The definition of natural science is a branch of science that examines real and abstract events in nature that must be proven using observations, observations, and experiments [1]. The solar system material is a science subject that is quite difficult for students because it is complex and abstract, and students cannot directly observe celestial objects and phenomena in the solar system [2]. In addition, the discrepancy of the media and the lack of means to understand the material of the solar system also resulted in many students having difficulty, being lazy, and tending to be bored in studying the material of the solar system [3]. Therefore, educators are expected to be able to adjust the learning media that will be used so that students become more interested in participating in learning and learning objectives can be achieved [2].

Learning media has the meaning of a tool that is used to assist in conveying or demonstrating a material to facilitate learning activities [4]. Using learning media and assisting educators in delivering subject matter to students can also help increase student interest and motivation to be more interactive and active when learning in class [5]. Learning media can also be used as a learning resource that must be utilized as much as possible to achieve an effective, conducive, efficient, and fun learning atmosphere [6]. Learning media include books, pictures, tape recorders, slides (picture frames), cassettes, video, television, and computers [7]. Learning media that

are currently often used in learning activities in the classroom include the use of textbooks, modules, photos, videos, and Microsoft PowerPoint [8]. These learning media tend to be less interactive and make students passive because they do not provide feedback and are less realistic and unattractive to students [9]. The use of less interactive learning media can affect student learning outcomes because students do not understand the material [10]. This problem also can cause a decrease in student interest in learning a lesson. It can impact student learning outcomes [11].

The development of information and communication technology today has had an impact on various fields, especially in the field of education [12]. The use of technology in education is becoming an important thing [13]. The types of learning media that can be used are also more and more varied, making it easier for students to understand. Augmented reality is one of the learning media that is starting to be developed at this time [14]. Augmented *reality* (AR) is a multimedia technology that can combine two-dimensional and three-dimensional virtual objects into the real world and then be projected in real-time [15]. Augmented reality technology is currently widely used in various fields, such as augmented reality in gaming, entertainment, medical, manufacturing, visualization, path planning, and the military [16]. Augmented reality technology in education can help teachers

in the teaching and learning process [17]. It is because augmented reality learning media can display material in the form of text, images, audio, 3D objects, and videos directly to students so that they can increase students' understanding of lessons easily [18].

Previous research conducted by Mauludin (2017) obtained the results of an increase in student learning outcomes. The group who studied the digestive system using augmented reality received a higher percentage increase in grades than those who studied the digestive system using only textbooks. Another study by Tresnawati (2021) obtained results where augmented reality technology was proven to help during learning and was assessed as a more interactive learning medium in delivering material.

The effectiveness of the learning media used in learning certainly depends on the perceptions of students and teachers [19]. Positive perceptions from students can certainly increase learning motivation so that when participating in learning, students will be happier and more enthusiastic [20]. On the other hand, negative perceptions will make students less motivated and lazy to participate in learning [20]. This negative perception can cause difficulties for students, causing avoidance of science subjects which can affect student learning outcomes in class [21]. This statement is in line with research conducted on 50 students of Kanaan Christian Middle School Jakarta, which showed that students' perceptions influenced 55.5% of science learning outcomes. In contrast, interest in learning had an effect of 30.3% on science learning outcomes [22]. From the research results above, it can be concluded that student perceptions are the most influential variable on science learning outcomes compared to learning interests [22].

Based on the description above, it is necessary to do further research that aims to describe students' perceptions of augmented reality learning media on solar system material. Is augmented reality learning media appropriate and effective in learning and can help students understand the learning of the solar system material? This student perception is considered important because it can assist teachers in utilizing augmented reality learning media to learn about the solar system.

## RESEARCH METHODS

This study is a descriptive study that aims to describe students' perceptions of augmented reality learning media on the material of the solar system. This research was conducted at State Junior High School 3 Sidoarjo in the even semester of the 2021/2022 academic year with 32 students from class 8C.

## Procedure

Research data was obtained using questionnaires and interviews. Students filled out questionnaires online using google forms before and after participating in learning about the solar system material with augmented reality media. Then the interview stage is carried out online through google meet after students fill out the questionnaire that has been given. Interviews were conducted on six students, three with the highest questionnaire and three others with the lowest questionnaire answers.

## Instruments

The questionnaire is an adaptation of the questionnaire previously developed by Abdinejad (2021). It has been tested for validity with a rcount value of 0.667, and reliability is 0.822, so the instrument used is valid and credible. The questionnaire contains five multiple choice questions about the solar system planets and five about the concept of the moon concerning augmented reality learning media. The questions used in the questionnaire were made based on indicators of the material of the solar system as follows:

Table 1. Indicators on student perception questionnaire

Number	Indicator
1	Planetary Models
2	Solar System Characteristics
3	Solar System Planets
4	Planetary Motion
5	Planetary Distance Comparison
6	Moon Phase
7	Rotational Motion
8	Revolutionary Motion
9	Impact of Rotation & Revolution
10	Seasonal Change

The interview stage is carried out after students fill out the questionnaire that has been given. This interview aims to complete the required result data and reconfirms student answers. The interview contains questions about students' opinions and comments on augmented reality learning media in learning material about the solar system.

## Data Analysis

Student perception questionnaires were analyzed by determining the percentage value based on student answers to each question contained in the questionnaire. The percentage of student answers is then converted according to the criteria for the percentage of students' answers. Augmented reality learning media on the solar system material can be effective if the

questionnaire answers get a percentage value of 61% with a good category [23].

Table 2. Criteria for the percentage of questionnaire answers

Percentage (%)	Criteria
0 – 20	Not good
21 – 40	Not good
41 – 60	Pretty good
61 – 80	Well
81 - 100	Very good

Data from interviews were analyzed descriptively by data reduction, data presentation, and conclusion [24]. Analysis of the data from

interviews with six students is expected to help to find out students' opinions about the weaknesses and strengths of augmented reality learning media, which is used as a reference for developing augmented reality learning media used today.

## RESULTS AND DISCUSSION

The research data regarding students' perceptions of augmented reality media on the planetary concept of solar system material is shown in Figure 1 below:

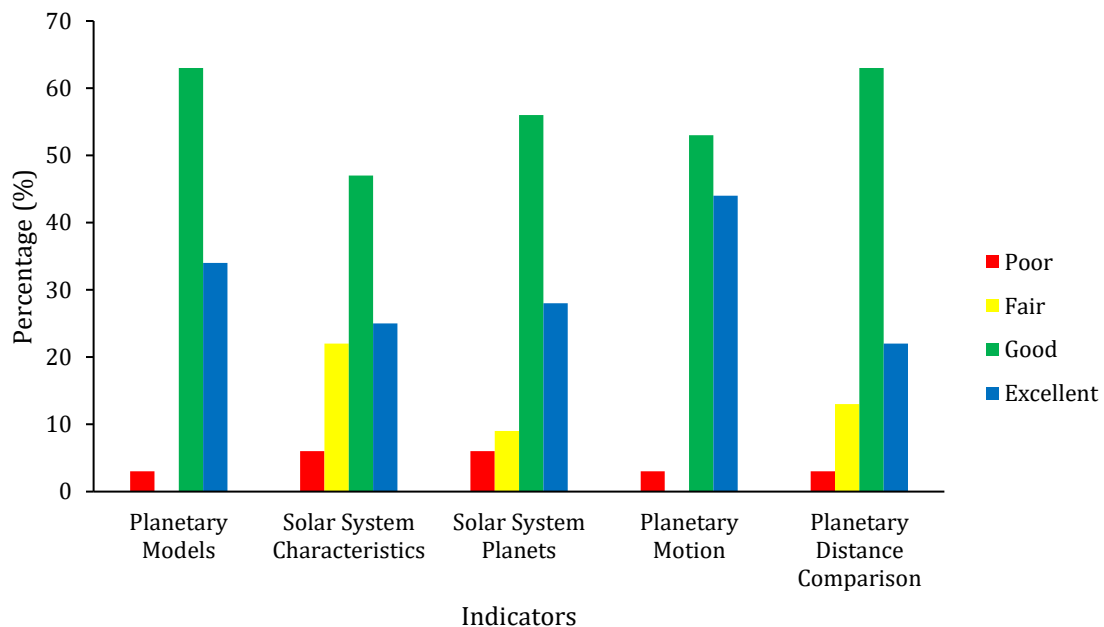


Figure 1. The results of the 8C student questionnaire answers related to the concept of the planet

Based on the results of the questionnaire related to the concept of the planets obtained in Figure 1, the results obtained in indicator 1, as many as 97% of 8C students assessed that augmented reality learning media could help them understand planetary models in the material of the solar system. In indicator 2, 72% of 8C students assess that augmented reality learning media can help them understand the characteristics of the solar system. In indicator 3, as many as 84% of 8C students considered that augmented reality learning media could help them understand the planets that make up the solar system. In indicator 4, 97% of 8C students assessed that augmented reality learning media could help them understand the planets' motion in the solar system's orbit. In indicator 5, as many as 85% of 8C students assessed that augmented reality learning media could help them understand the comparison of the distances of the components of the solar system.

These results show on indicators 1, 3, 4, and 5; students get results of 97%, 84%, 97%, and 85%, which are in the very good category. Students can easily understand the indicators of planetary models, planets making up the solar system, planetary motion, and comparisons of distances between planets by using augmented reality learning media. In indicator 2, students only get 72% results with good categories, which means students have little difficulty in understanding the components of the solar system using augmented reality learning media.

The research data regarding students' perceptions of augmented reality media on the solar system material concept of the moon is shown in Figure 2 as follows:

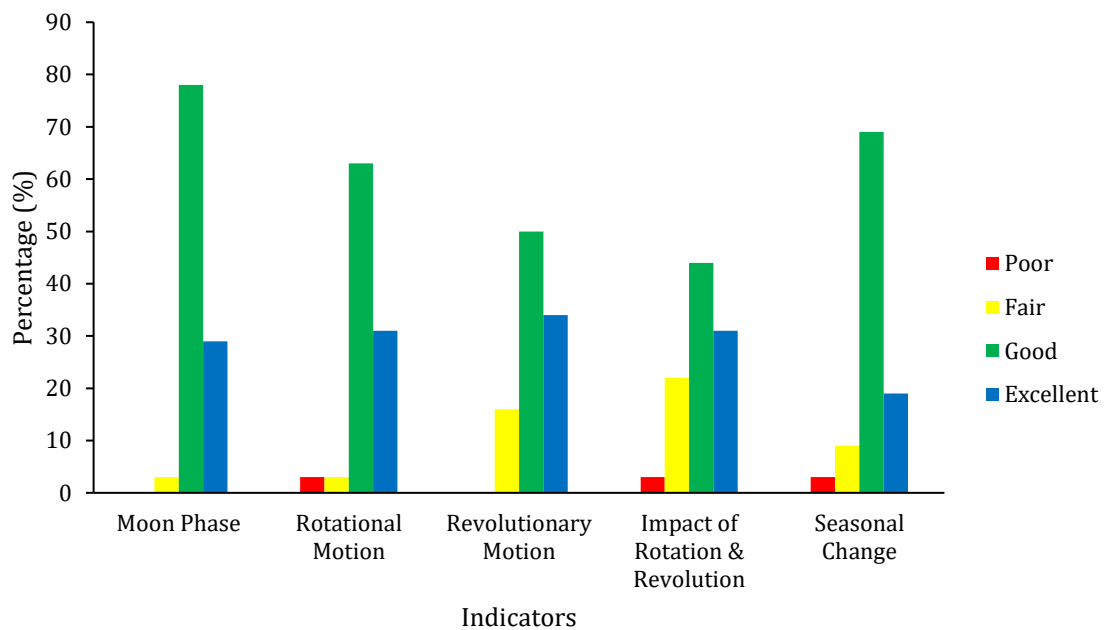


Figure 2. The results of the 8C student questionnaire answers related to the concept of the moon

Figure 2 indicates that as many as 97% of 8C students assessed that augmented reality learning media could help them understand the moon's various phases. In indicator 7, 94% of 8C students considered that augmented reality learning media could help them understand rotational motion. In indicator 8, as many as 84% of 8C students assessed that augmented reality learning media could help them understand revolutionary motion. In indicator 9, 75% of 8C students assessed that augmented reality learning media could help them understand events caused by rotational and revolutionary motion. In indicator 10, as many as 88% of 8C students assessed that augmented reality learning media could help them understand the changing seasons in the southern and northern hemispheres.

These results show that in indicators 6, 7, 8, and 10, students get results of 97%, 94%, 84%, and 88%, which are in the very good category. It means that students can very easily understand indicators of moon phases, rotational motion, revolutionary motion, and seasonal changes by using augmented reality learning media. In indicator 9, students only got 75% results in a good category, which means students have little difficulty in understanding the indicators of the impact of rotation and revolution using augmented reality learning media.

The results of the questionnaire analysis on both concepts showed that as many as 87% of 8C students could easily understand the solar system material by using augmented reality learning media. It can be concluded that augmented reality learning media is effectively used in learning solar system material [23]. This data is also supported by the

results of interviews with six students stated in the following sentences :

S1 : "Augmented reality is the most effective because it can see the planet directly and more clearly."

S2 : "It's good to use augmented reality, you can know about the solar system, and the pictures are good."

S3 : "Augmented reality learning media is more effective because it's just nice, there are pictures, there are more explanations."

S4 : "Actually, the learning media are equally effective, but augmented reality is more interesting because there are pictures and videos."

S5 : "Augmented reality is more effective, but I'm not used to it yet."

S6: "The most effective, in my opinion, is augmented reality because it is easy to understand, no need to imagine yourself."

Based on the results of interviews obtained from the six students, it can be concluded that, according to students, augmented reality learning media is the most effective learning media in studying solar system material. It is because students judge that augmented reality learning media is more transparent, interesting, effective, easy to use, has good pictures, more complete explanations, and is easier for students to understand. The results of the analysis that have been carried out show that most students give a positive response regarding the use of augmented reality learning media in the solar system material. The existence of a positive

response to the use of augmented reality learning media can significantly affect the academic achievement achieved by students [25]. These results are also reinforced by previous research on students' perceptions of augmented reality learning media, which also got positive results, especially on the effectiveness of the media, student interest, and ability to help improve student understanding. Respondents found the augmented reality application very interesting and helpful [26]. Other studies show a prominent positive feedback response regarding the effectiveness of augmented reality technology in helping students visualize complex chemical concepts in 3D to improve student understanding [27].

One of the advantages of augmented reality learning media is an attractive visual display because it can display 3D objects and their animations directly as if they appear in the real world and are equipped with information about 3D objects displayed in the form of text and audio [18]. The nature of augmented reality learning media is directly proportional to the dual code learning theory, or dual coding theory. A learning theory states that humans have two information channel systems between verbal and visual information; any information received will be processed through one of the two channels of information [28]. The dual code learning theory also states that when the learning media combines the two information channel systems, it will impact students' ease of absorbing information. They can improve memory skills and understanding of information so that student learning outcomes can later increase [29].

In solar system learning, learning media in the form of books and 2-dimensional images, students can only see planetary models from one side, while other planetary sides such as the back, top, bottom, and inner sides of each planet do not. It can be seen by students, causing them to feel complex and unable to know the complete form of each planet [30]. When using augmented reality learning media application, students can see the shape of the planets in the solar system entirely from various sides in 3D and are also equipped with text and audio explanations to help students understand how the shape of the models of the planets. In the solar system [31]. This statement follows the results of the student perception questionnaire, which shows that indicator 1, namely the planet model indicator, gets the highest percentage of 97% and is in the very good category.

Indicator 4, namely planetary motion, explains how the planets and their natural satellites move around the sun in a trajectory approaching a circle. Of course, this indicator will be complex for students to understand because the concept is [31]. This problem can be overcome with the help of augmented reality learning media because by using augmented reality, students can observe in 3D how the movement of each planet in the solar system

makes it easier for students to understand the material [31]. This statement follows the results of the student perception questionnaire, which shows that in indicator 4, the planetary motion indicator, the highest percentage is 97% and is in the very good category.

Augmented reality learning media can also display text, images, audio, and video material directly to students [18]. Learning media such as augmented reality can help students understand the moon's phases by displaying a 3D shape of the moon and explanations in the form of video, text, and audio. So students find it easier to understand material concepts such as moon phases because students can observe the concept of phases and the shapes moon in 3D without the need to observe directly in the field [32]. This statement follows the results of the student perception questionnaire, which shows that indicator 6, the moon phase indicator, gets the highest percentage of 97% and is included in the very good category.

Augmented reality learning media technology can help students overcome the obstacles contained in conventional learning media and can increase the effectiveness and interest of students in participating in learning. Augmented reality learning media also provides meaningful learning for students in various lessons requiring a deeper understanding of three-dimensional objects such as the solar system [33]. Augmented reality immersive technology has proven to be an effective and results-oriented tool in creating a more interactive learning environment for subjects ranging from STEM (Science, Technology, Engineering, and Math) to foreign language learning [34]. Learning using augmented reality learning media is also proven to increase the average score of students' critical thinking skills. Classes that use augmented reality learning media based on a scientific approach get an average score of essential thinking skills classified as critical categories.

In contrast, the conventional class's average score in crucial thinking skills is still classified as a less critical category [35]. Augmented reality learning media used, there are still some obstacles found when collecting data in the field, such as augmented reality learning media can only be run on smartphones with the Android operating system. Augmented reality learning media are still offline, so the information contained in augmented reality learning media is limited, and augmented reality learning media is still not stable, so there are still errors in several types of smartphones.

## CONCLUSION

Based on the data analysis from this study, it can be concluded that using augmented reality

learning media in the solar system material gets the percentage of students' answers by 87%. These results prove that augmented reality learning media is effectively used and can provide positive perceptions in learning about solar system material. These results are also supported by the results of interviews conducted with several students showing that students feel augmented reality learning media is the most effective learning media in studying the solar system. Therefore, it can be concluded that augmented reality learning media is effective and can help increase student interest in exploring the solar system. Furthermore, researchers can suggest that the use of augmented reality learning media can be applied to other abstract natural science materials that are abstract and difficult for students to find in everyday life, such as materials on the digestive system, plant structures, and the human skeletal system. Augmented reality learning media can provide better visualization to help students learn abstract material. For further research, it is hoped that there will be improvements in augmented reality learning media quality.

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