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Identifying Sixth Grade Students' Misconceptions on Solar System

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Abstract

The purpose of this study was to determine sixth grade students' misconception on the solar system. This study uses a sampling technique with a total sample of 88 students. This research uses the descriptive quantitative method. This research aims to describe the misconceptions on the material of the solar system in class 6 of public elementary school in Pekanbaru, data collection techniques using the Four Tier Test. The results showed that students' misconceptions were categorized as "medium" with an average of 47.58% of 88 students. The highest misconception on material related to the characteristics of stars with a misconception level of 67.61% with this level can be said that there are still many students who are investigated experiencing misconceptions. The lowest misconception is 27.27%, which is material about the sun as the center of the solar system.

Keywords: *diagnostic test; four-tier test; sixth grade students' misconceptions; solar system.*

1. INTRODUCTION

As stated in Law No. 20 of 2003 concerning the national education system, education is a conscious and planned effort to create an atmosphere of learning and learning process so that students actively develop their potential to have religious-spiritual strength, self-control, personality, intelligence, noble morals as well as the skills needed by himself, society, nation, and state.

Natural science is the science that is carried out with experimental investigations and theoretical explanations of phenomena that occur in the surrounding environment. These phenomena are understood by scientists

In science learning, students have a lot of experience and knowledge related to nature. All students have a lot of experience with motion, force, electricity, magnetism, energy, about living things, inanimate objects, and many other natural events that are known by students before conducting the learning process regardless of whether their knowledge is correct according to "concept" or not. With that experience intuition and "student theory" have been formed about natural events in the everyday environment of humans, but not necessarily intuitions and theories that have been formed are true.

Misconceptions or misconceptions that represent phenomena that are

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present in important discussions in physics and other sciences (Adi & Oktaviani, 2019; Astuti et al., 2020; N. Hermita et al., 2019, 2017; Parlina et al., 2019), because they are approved can be used in the process of assimilating new knowledge in the minds of students. Misconceptions oppose the inclusion of new ideas or leadership-new scientific revolution, other participants whose misconceptions can reject new ideas or ideas that are accepted, encourage them to find out the attainment of a complete understanding of teaching material (Hermita, 2017). Misconceptions on students should not be allowed and given must be reduced. If misconceptions that occur in elementary students are not immediately reduced, then these misconceptions will carry over until they become students (Hermita, 2017).

The concept is an important thing in teaching and learning activities (Wijaya, Sukma, et al., 2020; Wijaya, Ying, & Purnama, 2020; Wijaya, Ying, Chotimah, et al., 2020a). teachers must teach concepts properly to prevent misconceptions (Wijaya, Ying, Chotimah, et al., 2020b). Identification of misconceptions in science learning do in the learning process, this process can be done before, before, or before the learning process. This identification requires follow-up activities so students can release from misconception.

Misconception can happen to anyone. Students who like the teacher can also avoid misconceptions. The cause of this misconception is caused by (1) tests or assignments are rarely performed to see misconceptions, (2) misconceptions arise because of analogy errors, (3) many misconceptions arise from questions that are too fast, without being explained, (4) the existence slogans such as 'action equals reaction' and 'every result has a reason', will encourage superficial thinking (Pujayanto, 2011). Based on the background of the problems that have been previously described, the problem formulation in this study is "Are there any misconceptions in the material of the solar system in elementary school?

2. METHOD

Based on this, the research carried out research through misconception analysis of Grade VI students of SD Negeri 147 Pekanbaru on solar system material using questions related to the material to be discussed using the Four Tier Test instrument.

The four-tier diagnostic test or four-level multiple-choice diagnostic test is a test instrument that functions to reveal misconceptions that occur in students and detect concepts that are already understood and concepts that students do not understand (Wilantika, 2018). The four-tier diagnostic test is a refinement of the three-tier test by adding a level of confidence to the reasons chosen, as seen in Figure for example four-tier questions (Hermita, 2017).

To classify or categorize students in the concept of understanding concepts, not understanding concepts, misconceptions, and errors is done by examining students' answers and matching these answers with table 1 and

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analyzing and categorised based on table 2 (Sheftyawan, 2018; Marhadi et al., 2019).

Table 1. Design of Four-Tier Test

Question: Diagnose the state of student conception
Answer Choice (Tier 1): A. Alternative choice of first answer B. alternative choice of second answer C. alternative choice of third answer D. etc.
The First Confidence Rating Scale (Tier II) A. Alternative ontion if ”sure” over the selected answer B. Alternative ontion if ” not sure” over the selected answer
Reason (Tier III): A. Alternative choice of first reason B. alternative choice of second reason C. alternative choice of third reason D. Other Reasoning
The Second Rating Scale (Tier IV) A. alternative choice if convinced of the reasoning answer selected B. alternative choice if unsure of the chosen reasoning

Table 2. Percentage Rrate of Misconceptions Category

Percentage	category
0% ≤ P < 30%	low
31% ≤ P < 60%	middle
61% ≤ P < 100%	high

This developmental research produced a valid and reliable question instrument to measure students' misconceptions. The question instrument developed was a question consisting of four levels. The first level is multiple-choice questions, the second level is trust in the choice of answers in multiple-choice, and the third level is the reason for answers to multiple-choice and the fourth level is the student's confidence in the reasons given at level three. The material used is the properties of light. These questions were tested on 88 students (table 3). An assessment guide to the answers to questions made by students can be seen in table 4.

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Table 2. Total Population

No	Classes	The number of students per class
1	VI A	29
2	VI B	27
3	VI C	32
Total		88

Table 4. Instrument Grid

Variable	Indicator	Sub Indicators	Question number
Misconception	Solar Systems	The sun is the center of the solar system	1
		Star features	2, 4
		The characteristics of the moon	5, 12
		Planet and its identification	7, 10, 11, 13, 14
		Rotation and revolution	6, 15
		Celestial bodies other than planets and the sun (Asteroid, Meteor, Comet, Satelite)	3, 8, 9

3. RESULTS

The implementation of this research began in October 2019 at SD Negeri 147 Pekanbaru involving 88 students divided into three classes, namely classes VI A and VI B and VI C. This study uses a sampling technique while total sampling is a sampling technique. where the number of samples equals the population. This research uses the descriptive quantitative method. It aims to describe the misconceptions on the material of the solar system in class VI of SD Negeri 147 Pekanbaru, data collection techniques using the Four Tier Test.

The test used in this study is in the form of questions related to the material of the solar system with a 4-level confidence level. For tier 1, the choice of answers to the questions raised, tier 2, namely the level of confidence in the choice of answers in tier 1, tier 3, the reasons for tier 1, and tier 4, the level of confidence in tier 3. Before the research instrument was distributed to students, the instrument the test was validated.

The material of the solar system in this study is divided into 6 sub-indicators namely, 1) the Sun as the center of the solar system, 2) the characteristics of the stars, 3) the characteristics of the moon, 4) the planet and its identification, 5) rotation and revolution and 6) objects sky other than planets and sun (Asteroid, Meteor, Comet, Satellite). In processing research data, researchers calculate

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manually by adjusting the decision level to 4 levels (four-tier test).

Data collection in this study was conducted in semester 1 (odd) 2019/2020 school year i.e. starting November 18, 2019-10 December 2019

a. Problems with the level of understanding the concept category

Based on data from research tests that have been conducted, it can be seen the percentage of students who understand the concept in each sub-indicator in figure 1.

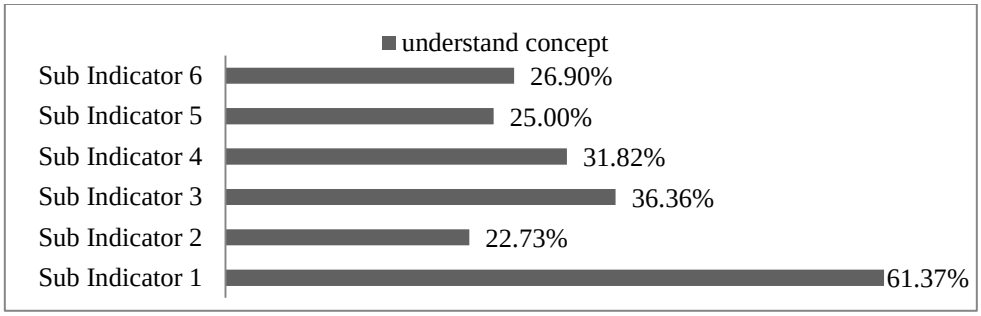

Figure 1. Students' Conception Profile on Medium Category

can be seen the level of understanding of the concept of students in the category of "medium" with an average of 31.29% of 88 students. Sub indicator 1 (the sun as the center of the solar system) with a percentage of 61.37% of 88 students who understand the concept, this is categorized as "high". In sub-indicator 2 (star traits) with a percentage of conceptual understanding of 22.73% of 88 students categorized as "medium". Sub Indicator 3 (characteristics of the month) with the percentage of students understanding the concept of 36.36% of 88 students categorized as "high". Sub indicator 4 (planet identification) students have a conceptual understanding of 31.82% of 88 students who fall into the "medium" category. Sub indicator 5 (rotation and revolution) students have a concept of 25.00% of 88 students and enter the "low" category. And finally on sub-indicator 6 (Celestial bodies other than planets and the sun (Asteroids, Meteors, Comet, Satellites)) students have a concept of 26.90% of 88 students and enter the "low" category. This proves that understanding the concept of grade VI students at SD Negeri 37 Pekanbaru on the material of the solar system is still not quite high.

b. Problems with category level do not understand the concept

From the results of grouping the results of student answers, we get a percentage of not understanding the concepts contained in each item according to the graph.

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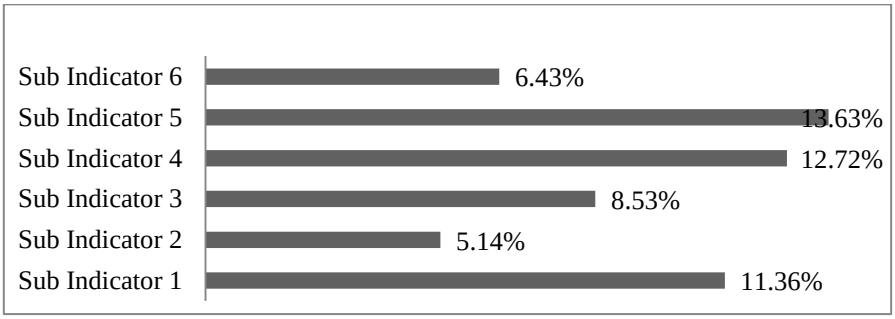

Figure 2 Students' Conception Profile on Low Category

Based on figure 2, it can be seen that the level of not understanding students' concepts is categorized as "low" with an average of 9.93% of 88 students. Not understanding the highest concept lies in Sub Indicator 5 with a percentage of 13.63%. Sub indicator 1 (the sun as the center of the solar system) with a percentage of 11.36% of 88 students who do not understand the concept, is categorized as "low". In sub-indicator 2 (the characteristics of stars) with a percentage of not understanding the concept of 5.14% of 88 students categorized as "low". Sub Indicator 3 (characteristics of the month) with the percentage of students not understanding the concept of 8.53% of 88 students categorized as "low". Sub indicator 4 (planet identification) students have not understood the concept of 12.72% of 88 students who fall into the "low" category. Sub indicator 5 (rotation and revolution) students do not understand the concept of 13.63% of 88 students and fall into the "low" category. And finally on sub-indicator 6 (Celestial bodies other than planets and the sun (Asteroids, Meteors, Comet, Satellites) students have not understood the concept of 6.43% of 88 students and enter the "low" category. This proves that not understanding the concept of grade VI students of SD Negeri 147 Pekanbaru in the matter of the solar system is still relatively low.

c. Problems with the level of misconception

From figure 3 we can see that students' misconceptions are categorized as "medium" with an average of 47.58% of 88 students. Sub indicator 1 (the sun as the center of the solar system) with a percentage of 27.27% of 88 students who misconceptions, this is categorized as "low". In sub-indicator 2 (star characteristics) with a percentage of misconceptions of 67.61% of 88 students categorized as "high". Sub Indicator 3 (characteristics of the month) with the percentage of students' misconceptions of 46.59% of 88 students categorized as "medium". Sub indicator 4 (planet identification) students experience misconceptions of 45.23% of the 88 students who fall into the "medium" category. Sub indicator 5 (rotation and revolution) students experience misconceptions of 46.02% of 88 students

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and fall into the "medium" category. And finally in sub-indicator 6 (Celestial bodies other than planets and the sun (Asteroids, Meteors, Comet, Satellites) students experience misconceptions of 46.59% of 88 students and fall into the "medium" category. This proves that there are still many VI-grade students of SD Negeri 147 Pekanbaru who experience misconceptions about the solar system material being tested.

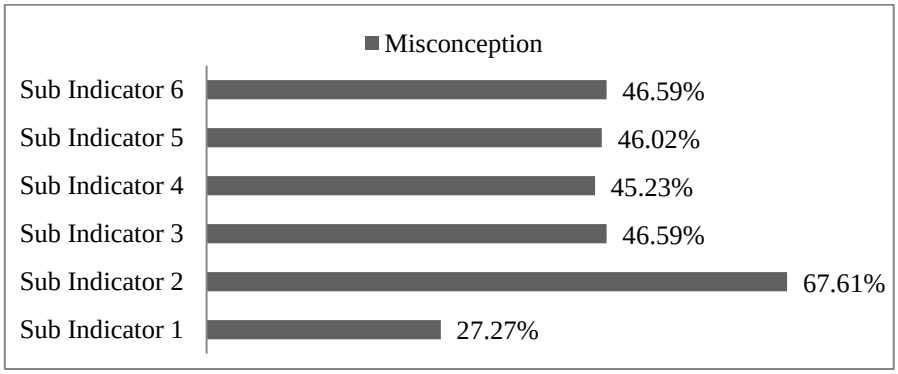

Figure 3 Students' Conception Profile on Misconception Category

d. Problems with error category levels

can be seen that the level of student error is categorized as "low" with an average of 11.20% of 88 students. Sub indicator 1 (the sun as the center of the solar system) with a percentage of 0% of 88 students who error, this is categorized as "low". In sub-indicator 2 (the characteristics of stars) with 4.52% of 88 students, the error percentage is categorized as "low". Sub Indicator 3 (characteristics of the month) with a percentage of student error of 8.52% of 88 students categorized as "low". Sub indicator 4 (planet identification) students experienced an error of 10.23% of the 88 students included in the "low" category. Sub indicator 5 (rotation and revolution) students experience an error of 15.34% of 88 students and enter the "low" category. Finally, in sub-indicator 6 (Celestial bodies other than planets and the sun (Asteroids, Meteors, Comet, Satellite)) students experienced an error of 20.08% of 88 students and entered the "low" category. This proves that the grade VI students of SD Negeri 37 Pekanbaru on the material of the solar system experienced low errors.

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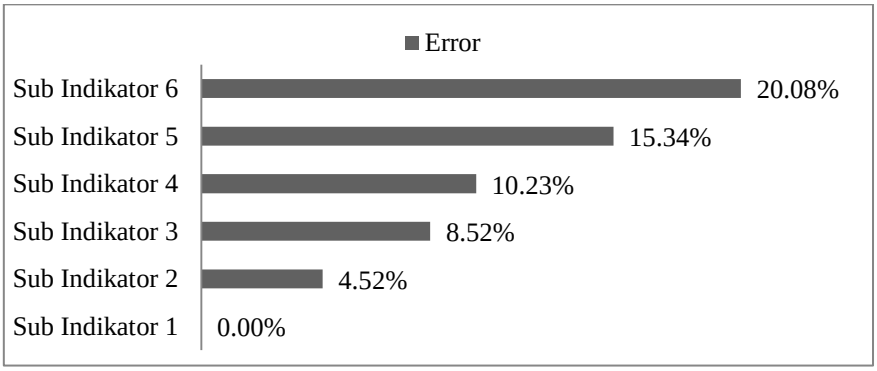

Figure 4 Students' Conception Profile on Error Category

4. DISCUSSION

The causes of misconceptions include the use of teaching methods. Teaching methods that only contain lectures and writing, do not reveal misconceptions, narrow demonstration models and non-multiple intelligence are the main causes of misconceptions (Soeparno, 2013). So that the ability of the teacher to use the learning method in the form of a lecture as found in the field is a factor in the high misconceptions on material related to the solar system. This condition can cause children to easily forget the material they are learning so that what is experienced in everyday life causes students to experience the wrong (context) about the material of the solar system. Another factor that causes students to experience misconceptions is also due to the ability of the students themselves, for example, students pay less attention to the teacher when explained about the subject matter.

Students' mistakes in understanding the material caused by student experience (context) are a form of humanistic thinking in which the thinking is thought that views all objects from a human perspective. The behavior of objects is understood as the behavior of living things, so it is not suitable (Nurulwati, 2014). Conditions can occur because the level of understanding of students is still at a concrete stage and this also occurs because students do not get explanations from people around them to explain the true thing.

One of the efforts to overcome misconceptions is by remedying misconceptions through remedial teaching activities. One of the remedial teaching modes that can be used is text mode, and to remediate misconceptions, conceptual change text or CCText can be used. Conceptual change text (CCText) is a type of text that is deliberately developed for remedial teaching-oriented to remediation of misconceptions experienced by students (Hermita, 2017).

Overcoming misconceptions requires learners to be aware of misunderstandings and be dissatisfied with them and substitute concepts to become available understandable, sensible, and valid learning cycles identify misunderstandings in the early

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stages of learning and teachers can easily stop teaching and then redirect concepts (N. Hermita et al., 2020; Neni Hermita et al., 2020;). The learning cycle teaching approach prevents misunderstanding in three ways; understanding of concepts, improved problem solving, better laboratory skills, and also technological tools help eliminate misconceptions (Turkmen, 2007).

5. CONCLUSION

Based on the results and discussion of the research, it can be concluded that the misconceptions of grade VI SD students on the material of the solar system are still quite high. The highest misconception category was material related to star characteristics with a conceptual understanding of 67.61% and the lowest was material regarding the sun as the center of the solar system with a misconception of 22.27%. The highest level of student misconception for each item was item number 4, the sub-indicator of star characteristics, which received a percentage value of 64.77% while the lowest level of student misconception was in item number 1 the indicator of the sun as the center of the solar system with a percentage 27.27%.

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