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PROFILE OF MISCONCEPTIONS OF GRADE VII STUDENTS OF SMPN 1 SAMBONG ON TEMPERATURE, HEAT AND EXPANSION MATERIALS

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Abstract

Abstract: The purpose of this study is to identify students' misconceptions about the concepts of temperature, heat and expansion and describe the profile of misconceptions that occur. The subjects of the study used were 32 students of SMP Negeri 1 Sambong Blora district class VII B. The research instrument used was a diagnostic test with the CRI (Certainty of Response Index) method in the form of multiple choice. Based on the test results, students are grouped into 5 categories, namely concept understanding (PK), not understanding concept (TPK), misconception (M), lucky guess (LG) and neutral (N). The percentage of students who understand the concept is only 49.8%, students who do not understand the concept by 5.7%, lucky guess students by 3.0%, students in the neutral category by 16.8% while students who experience misconceptions reach 24.7%. The highest percentage of misconceptions occurred in the concept of temperature and heat, which was 34%.

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1. INTRODUCTION

The concept of Natural Sciences (IPA) is beneficial for students to solve problems found in everyday life. Problem solving in science subjects requires understanding concepts. The concept of science that students can understand well can be used and applied in daily life because science is a science that comes from nature and is studied for the balance of nature. Understanding concepts is a very crucial aspect in the science learning process.

Understanding the concept of science includes a series of stages, starting from the ability of students to observe science objects, ask questions about natural phenomena, conduct scientific experiments, connect data obtained from experiments and information, to communicate about the results that have been achieved. Understanding the concept of science is not just memorizing subject matter, but is the result of the formation of knowledge carried out by students themselves.

Low understanding of concepts is still a challenge in the global education sector. Although before focusing on the development of other learning skills, it is important for students to understand the concepts first. Mistakes in understanding concepts can lead to misconceptions in students, making it difficult for them to understand similar new concepts (Yuliati, 2017; Irani, et al., 2020). Students are able to identify and explain the relationship between concepts when the concept understanding is good. They can also apply the concepts they have learned to solve challenges, both simple and complex.

Misconception or misconception refers to a concept that is not in accordance with the scientific understanding or understanding accepted by experts in a certain field (Suparno, 2013). Misconceptions can arise in a variety of disciplines and students' education levels. Mistakes in understanding concepts by students can lead to a low level of understanding of concepts. Misconceptions can occur when students are not correct in understanding concepts, use concepts incorrectly, misclassify example problems, cause confusion between different concepts, and deviate from the supposed relationship between concepts.

Misconceptions can occur from the results of observations of natural phenomena that are understood using feelings and concepts that are not in accordance with the mental development of students (Septiana, et al., 2014). Student learning

needs to be adjusted to their mental development stage, because if students are not ready to accept a learning concept, there may be mistakes in understanding the concept. If the learning process is not in accordance with the mental development of students, this can be one of the causes of misconceptions.

From several points of view, misconception can be explained as students' understanding of a concept that is not in line with the scientific concept accepted by experts. The misconception experienced by students cannot be considered as complete ignorance, but rather as the existence of the initial concept that the student already has as a result of experience. In this case, experience forms intuition and theories that are the basis of students' thinking, so that misconceptions are not simply the absence of understanding, but the existence of an understanding that needs to be corrected in accordance with the correct scientific concept.

Science education is an important foundation in shaping students' understanding of natural phenomena. However, it is not uncommon for us to encounter challenges in the learning process, especially related to student misconceptions. One of the topics that often causes misconceptions is the material of temperature, heat, and expansion. This is like research conducted by Iriyani (2012), Lestari & Linuwih (2014) and Wulandari (2018).

An understanding of temperature, heat, and expansion should be a solid foundation for students to understand a variety of more complex physics concepts at the next level. However, we often find that students develop a misunderstanding or misconception of these concepts. This misconception can be a serious obstacle to further learning and needs to be examined in depth.

2. METHOD

This research is a descriptive research using qualitative descriptive methods in explaining the results of the research. The data collection technique through the test is to use a multiple-choice diagnostic instrument equipped with confidence levels and open interviews. The diagnostic result data is expressed in the form of a percentage of the student conception category.

The research was carried out at SMP Negeri 1 Sambong, Blora regency for the 2023/2024 school year. The time for conducting the research starts from November to December 2023. The population in this study is all students in grade VII of SMP Negeri 1 Sambong, Blora regency in the odd semester of the 2023/2024 school year consisting of seven classes, namely classes VII A, VII B, VII C, VII D, VII E, VII F and VII G totaling 218 students. The sample that will be used in the study is class VII B totaling 32 students, with details of the number of female students 16 students and male students 16 students. Sampling uses the purposive sampling technique because not all grade VII is taught by the same teacher for science subjects.

The research instruments used are diagnostic instruments and student interview guidelines. The diagnostic instrument was developed based on misconceptions on the concepts of temperature, heat and expansion referred to from several related journals. The research instrument was prepared in the form of an objective question test sheet. Meanwhile, interview guidelines are developed according to the results of misconception diagnosis. The interview questions are the same as those on diagnostic instruments.

The objective question test used consisted of 10 multiple-choice questions on Temperature, Heat and Expansion material with four answer options for each test question. The objective test is equipped with a CRI (Certainty of Response Index) method with a confidence level scale of 0-5. The grid of objective test questions can be seen in Table 1.

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Table 1. Diagnostic test instrument grid

No.	Konsep yang terkait	Indikator	No. Soal
1.	Menjelaskan konsep kalor	Siswa dapat menjelaskan kalor.	1
		Siswa dapat menjelaskan syarat transfer kalor, yaitu adanya perbedaan suhu benda.	2
2.	Menegaskan konsep suhu	Siswa dapat menjelaskan bahwa sentuhan (oleh kulit) tidak dapat digunakan untuk mengukur suhu suatu benda.	3
		Siswa dapat mengkonsepkan bahwa suhu suatu benda tidak bergantung banyak sedikitnya ataupun besar kecilnya ukuran suatu benda	4
3.	Menjelaskan pengaruh kalor terhadap perubahan suhu benda	Siswa dapat menjelaskan sebab air dingin dapat menurunkan suhu benda yang bersuhu tinggi	5
4.	Menganalisis pengaruh kalor terhadap perubahan wujud benda	Siswa dapat menjelaskan kalor yang terus-menerus diterima benda tidak hanya akan digunakan untuk menaikkan suhu benda namun juga mengubah wujud benda.	6
5.	Menentukan ukuran benda karena pengaruh perubahan suhu benda (pemuaian)	Siswa dapat menjelaskan bahwa koefisien muai panjang benda sebanding dengan pertambahan panjang benda.	7
6.	Menerapkan konsep perpindahan kalor dengan cara konduksi dalam kehidupan sehari-hari	Siswa dapat menerangkan logam berfungsi sebagai konduktor yang baik, yang berarti mudah menghantarkan kalor dari suatu benda ke benda lain.	8
7.	Menerapkan konsep perpindahan kalor secara konveksi pada kehidupan sehari-hari	Siswa dapat menerapkan konsep perpindahan kalor secara konveksi saat mencampurkan antara air bersuhu rendah dan air bersuhu tinggi.	9
8.	Menerapkan konsep perpindahan kalor dengan cara radiasi pada kehidupan sehari-hari	Siswa dapat menjelaskan peristiwa menjemur pakaian termasuk contoh dari peristiwa transfer kalor dengan cara radiasi, karena kalor berpindah tanpa melalui zat penghantar (ruang hampa).	10
	Jumlah soal		10

The data analysis technique used in this research is CRI (Certainty Response of Index) analysis used in the instrument. The steps used in the CRI, namely determining the fraction of students who answered correctly and students who answered incorrectly, and second, determining the scale value for the CRI. The CRI scale used refers to the scale made by Saleem Hasan as shown in Table 2.

Table 2. CRI Confidence Level

CRI	Kriteria
1	Almost guess
2	Not sure
3	Sure
4	Almost certain
5	Certain

The objective test result data that has been filled in by students is determined by the category of students' level of understanding of concepts. Determination of the category of students' level of understanding of concepts based on the contribution of correct or incorrect answers and low or high CRI scores as shown in Table 3.

Table 3. Criteria for Understanding Student Concepts

Answer Criteria	Low CRI (<3)	CRI=3	High CRI (>3)
True	Lucky guess	Neutral	Understand the concept
False	Didn't understand the concept	Neutral	Misconceptions

The results obtained are presented in the form of a table and then analyzed to distinguish between conceptual, non-conceptual, misconception, lucky guess and neutral. The last step is to calculate the percentage of students against the five assessment results in each category with a formula proposed by Arikunto (Arikunto, 2005).

$$P = \frac{f}{N} x\ 100\%$$

Information:
P = Percentage value of respondents
f = frequency of resppondent answers
N = number of respondents 100% = constant number

The results of student categorization are then used as the basis for interviews to find out whether the CRI test used is really able to identify the misconceptions of students that have been obtained. Interviews were also conducted to find out the causes of students mastering concepts, misconceptions, guessing/not being confident, and not knowing concepts. A percentage analysis was also carried out for student conceptions so that student conceptions in general were obtained on diagnostic instruments and percentage of student conceptions on the temperature and heat subconcepts.

3. RESULTS AND DISCUSSION

The first step of descriptive analysis carried out by the researcher is to examine and group students' answers on each question into five categories, namely understanding concepts, misconceptions, not knowing concepts, lucky guesses, and neutral. Based on the results of processing the data of the misconception

diagnostic test with the CRI method, it can be seen that the average student still experiences misconceptions in the given question items. This proves that in the material of temperature, heat and expansion, students still experience many misconceptions. Students understand the concept only 49.8%, students do not know the concept by 5.7%, lucky guess students by 3.0%, students in the neutral category by 16.8% while students who experience misconceptions reach 24.7%. The data on the average percentage of students' conception of the given question items is shown in Table 4.

Table 4. Average Percentage of Student Conception

Kategori	Presentase
Understand the Concept (PK)	49,8 %
Misconceptions (M)	24,7 %
Not Understanding the Concept (TPK)	5,7 %
Lucky Guess (LG)	3,0 %
NeUtral (N)	16,8 %

The percentage of misconceptions can be seen from each question item, so that it can be known which questions can cause more misconceptions about students. Each problem is grouped into 3 sub-concepts, namely the difference in temperature and heat, expansion and heat transfer. The description of students' misconceptions in each question item can be seen in table 5.

Table 5. Percentage of Student Conception of Each Question Item

	PK		M		TPK		LG		N	
Butir Soal	Jumlah	%	Jumlah	%	Jumlah	%	Jumlah	%	Jumlah	%
Konsep suhu dan kalor										
1	15	47	10	31	3	9	1	3	3	9
2	12	38	9	28	1	3	1	3	9	28
3	14	44	3	9	2	6	1	3	12	38
4	5	16	15	47	1	3	0	0	11	34
5	11	34	13	41	2	6	0	0	6	19
6	9	28	13	41	3	9	1	3	6	19
Konsep pemuaian										
7	22	69	3	9	2	6	2	6	3	9
Konsep perpindahan kalor										
8	22	69	3	9	2	6	3	9	2	6
9	22	69	5	16	2	6	1	3	2	6
10	27	84	3	9	1	3	1	3	0	0

Table 5 shows that of the 32 students studied, it can be seen that the percentage of student conception is quite diverse. Based on Table 5, a diagram can be made as shown in Figure 1.

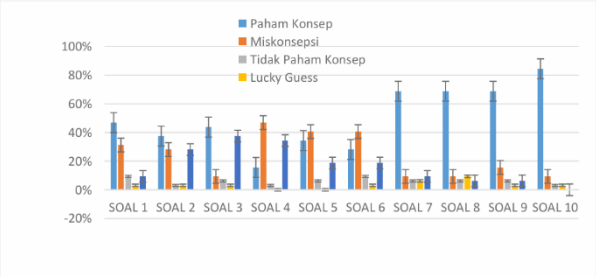


Figure 1. Percentage Diagram of Student Conception for Each Question Item

Based on Table 5 and Figure 1, it can be seen that students experience misconceptions in all the questions tested. In addition, based on the answer data from 32 students obtained, it is known that none of the students answered correctly in all the questions tested. The highest percentage of misconceptions occurred in question number 4, which was 47% (as many as 15 -20% 0% 20% 40% 60% 80% 100% QUESTION 1 QUESTION 2 QUESTION 3 QUESTION 4 QUESTION 5 QUESTION 6 QUESTION 7 QUESTION 8 QUESTION 9 QUESTION 10 Understand the Concept of Misconception Not Understanding the Concept of Lucky Guess Students). On the other hand, the misconception with the lowest percentage occurred in question items 3, 7, 8 and 10, which were 3 students each with a percentage of 9%. The data that has been presented shows that in question number 10, many students already understand the concept of heat transfer because similar examples are often found in daily life. Meanwhile, the question items that still experience high misconceptions are in questions 1, 2, 4, 5, 6 because it is difficult for students to distinguish the concept of temperature and heat difference. Many students are deceived by the choice of answers provided and the origin of answering.

The average value of the level of misconception of each concept shows that the concept of temperature and heat has the highest average misconception compared to the other 2 sub-concepts. The percentage of students'

conception of each concept can be seen in Table 6.

Table 6. Percentage of Student Conception on Each Concept

Concept	PK	M	TPK	LG	N
Temperature and Heat	34,5	34	6	2	24,5
Expansion	69	9	6	6	9
Heat Transfer	74	11	5	5	4

Meanwhile, the percentage of misconceptions in each concept can be seen in Gigure 2.

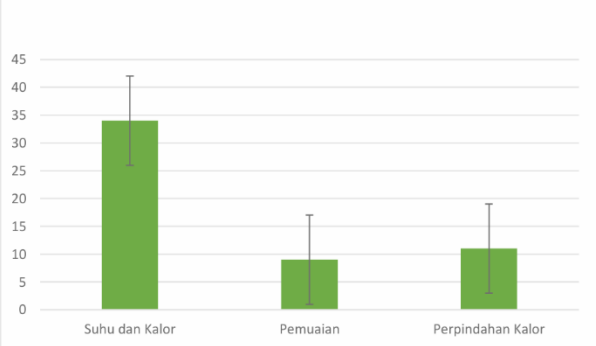
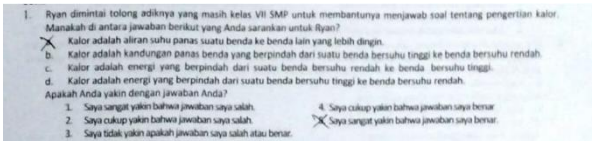


Figure 2. Percentage of Misconceptions on Each Concept

Based on table 6 and figure 2, it can be seen that the average percentage of understanding the concept is the highest in the concept of heat transfer, which is 74%. Meanwhile, the most misconceptions among students occurred in the concept of temperature and heat, which was 34%.

The cause of misconceptions is not only the type of question, but many factors in students that can be the reason for the wrong concept. Suparno (2013) mentioned several factors that cause misconceptions in students, such as student preconceptions, associative thinking, humanistic thinking, incomplete reasoning, wrong intuition, student cognitive development, student ability, and student learning interest. Here are some misconception profiles that occur in 3 questions with the highest level of misconceptions, namely in the Concept of Temperature and Heat

In the concept of temperature and heat, the average student who experiences misconceptions is 34%, where students consider that temperature and heat are two things that are the same thing. This misconception occurred in question number 1 by 31% and number 5 by 41%. This can be seen from the answer sheets of students who experienced misconceptions, namely for question item number 1 in figure 3 and picture 4, while question item number 5 in figure 5 and picture 6 and excerpts from interviews with students.


1. Ryan dimintai tolong adiknya yang masih kelas VII SMP untuk membantunya menjawab soal tentang pengertian kalor. Manakah di antara jawaban berikut yang Anda sarankan untuk Ryan?
   a. Kalor adalah aliran suhu panas suatu benda ke benda lain yang lebih dingin.
   b. Kalor adalah kandungan panas benda yang berpindah dari suatu benda bersuhu tinggi ke benda bersuhu rendah.
   c. Kalor adalah energi yang berpindah dari suatu benda bersuhu rendah ke benda bersuhu tinggi.
   d. Kalor adalah energi yang berpindah dari suatu benda bersuhu tinggi ke benda bersuhu rendah.

Apakah Anda yakin dengan jawaban Anda?
1. Saya sangat yakin bahwa jawaban saya salah.
2. Saya cukup yakin bahwa jawaban saya salah.
3. Saya tidak yakin apakah jawaban saya salah atau benar.
4. Saya cukup yakin bahwa jawaban saya benar.
5. Saya sangat yakin bahwa jawaban saya benar.

Figure 3. Answer sheet number 1

Interview excerpts:

Teacher: Nang, yesterday your answer to question number 1 was A and you are very sure that your answer is correct

Student : Heat is the flow of temperature from hot to cold, ma'am.

Teacher : What is the temperature itself?

Student : How hot or cold is an object, ma'am?

Teacher : That's right, it means that it can be said that temperature is a measure of the heat or cold of an object. Now in your opinion, if temperature is a measure, can it flow?

Student : I mean, ma'am, I don't understand yet.

Teacher : Well, the temperature is a magnitude. The same is true for length and mass. Can that amount flow?

Student : Yes, you can't, ma'am.

Teacher : At the beginning, you said that heat is a flow of temperature, which means that you think temperature can flow, right?

Student: Yes, ma'am, the heat will be transferred, ma'am. There is conduction, convection and radiation. It means that it can be said to flow.

Teacher : Iyess, that's right. More precisely, what flows is not temperature, but energy.

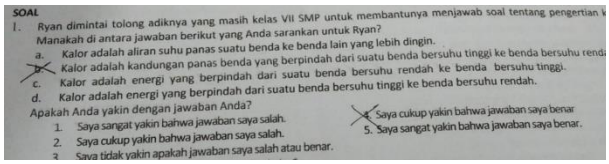
Student : So heat is the flow of energy from hot to cold temperatures

Teacher : To be precise, heat is a form of energy that can flow or move from high-temperature objects to low-temperature objects. Or known as hot energy.

Student : Owalah, yes ma'am. I think the temperature and heat are the same, ma'am.

Teacher : Now you understand the difference? Temperature is a measure, while heat is a form of energy.

Student : Understand now, ma'am. Thank you, Mrs. Setya.


SOAL
1. Ryan dimintai tolong adiknya yang masih kelas VII SMP untuk membantunya menjawab soal tentang pengertian
Manakah di antara jawaban berikut yang Anda sarankan untuk Ryan?
a. Kalor adalah aliran suhu panas suatu benda ke benda lain yang lebih dingin.
b. Kalor adalah kandungan panas benda yang berpindah dari suatu benda bersuhu tinggi ke benda bersuhu rend
c. Kalor adalah energi yang berpindah dari suatu benda bersuhu rendah ke benda bersuhu tinggi.
d. Kalor adalah energi yang berpindah dari suatu benda bersuhu tinggi ke benda bersuhu rendah.
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1. Saya sangat yakin bahwa jawaban saya salah.
2. Saya cukup yakin bahwa jawaban saya salah.
3. Saya tidak yakin apakah jawaban saya salah atau benar.
4. Saya cukup yakin bahwa jawaban saya benar
5. Saya sangat yakin bahwa jawaban saya benar.

Figure 4. Answer sheet number 1

Interview excerpts:

Teacher: Nang, yesterday you answered question number 1 is B and you are quite sure that your answer is correct. Now Mrs. Setya asks again, what do you think heat is?

Student : Hot, Mrs.

Teacher : What does heat mean?

Student : Heat that can move around, ma'am.

Teacher : What is a concrete example?

Student: Like a bonfire, ma'am. The heat in the middle of the field can reach those of us who line up on the edge of the field, ma'am.

Teacher : Okay, that's right. What can the heat move for?

Student : Blown by the wind, ma'am.

Teacher : Yes, if the heat is in the campfire, what if the heat in the boiling water is hot? Is it because of the wind too?

Student : No, ma'am. So I'm confused, ma'am.

Teacher : This is good, basically heat is a form of energy. The name energy can be transferred.

Student : So heat is not heat, ma'am?

Teacher : More precisely, heat is hot energy.

Student : My answer yesterday was wrong, ma'am? I answered that the content was hot, ma'am.

Teacher : That's right, so which is the right answer?

Student : Rich the D, Mrs. energy that moves from high-temperature objects to low-temperature objects.

Teacher : sip, best.

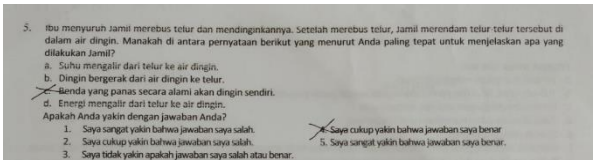

5. Ibu menyuruh Jamil merebus telur dan mendinginkannya. Setelah merebus telur, Jamil merendam telur-telur tersebut di dalam air dingin. Manakah di antara pernyataan berikut yang menurut Anda paling tepat untuk menjelaskan apa yang dilakukan Jamil?
a. Suhu mengalir dari telur ke air dingin.
b. Dingin bergerak dari air dingin ke telur.
c. Benda yang panas secara alami akan dingin sendiri.
d. Energi mengalir dari telur ke air dingin.
Apakah Anda yakin dengan jawaban Anda?
1. Saya sangat yakin bahwa jawaban saya salah.
2. Saya cukup yakin bahwa jawaban saya salah.
3. Saya tidak yakin apakah jawaban saya salah atau benar.
4. Saya cukup yakin bahwa jawaban saya benar
5. Saya sangat yakin bahwa jawaban saya benar.

Figure 5. Answer sheet number 5

Interview excerpts:

Teacher : Cah ayu, in question no. 5 you answered C. Try Mrs. Setya want to know if you think the heat and temperature are the same or different?

Student : I think they are the same, ma'am.

Teacher : Try to explain what temperature is and what heat is?

Student : Temperature is the degree of heat or cold of an object. If it's hot.

Teacher : Whose heat is it?

Student : The heat that objects have. If there is heat, the object will get hot, ma'am.

Teacher : So in your opinion, the cold thing has no heat, is that so?

Student : Nggih, ma'am. Or there is but a little.

Teacher : Okay, your thinking is not entirely wrong. Let's try to detail the concept of heat and temperature. Have you ever done activities related to temperature and heat?

Student : What is it, ma'am? Boil the water, ma'am.

Teacher : Good. How does the water process get hot and boil over time?

Student : The heat moves from the stove fire to the pot and continues to the water, ma'am.

Teacher : Steady. So the stove radiates heat to the pot. To put it more simply, heat is the energy that moves. Similar to question no. 5, hot eggs are soaked in water, so what happens?

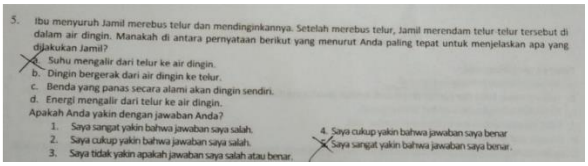
Student : The heat of the egg moves to the water so that the water becomes warm and the egg is somewhat less hot.

Teacher : Yes, that's right. What changes the heat energy, not the temperature. So it can be understood now?

Student : Nggih, ma'am. The answer is D, ma'am.

Teacher : That's right.

Student : Thank you, Mrs. Setya.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2. Saya cukup yakin bahwa jawaban saya salah.
3. Saya tidak yakin apakah jawaban saya salah atau benar.
4. Saya cukup yakin bahwa jawaban saya benar
5. Saya sangat yakin bahwa jawaban saya benar.

Figure 6. Answer sheet number 5

Interview excerpts:

Teacher: Nok, you answered question no. 5 A. According to your understanding, what is the relationship between temperature and heat?

Student : I think yes, it's the same, ma'am. If there is a hot object, then the temperature can move to a cold object.

Teacher : Well, here there is a misconception, nok. The temperature is a measure of how hot and cold an object is. Can a size be moved? The same is true for length or mass. Can they move?

Student : No, ma'am. I think the temperature of the object moves from hot to cold, ma'am. It means that hot eggs continue to become cold that moves, ma'am?

Teacher : The temperature does not change, but what is transferred is heat energy or what we know as heat. Heat moves from high-temperature objects to low-temperature objects.

Student: Oh, no, ma'am, I'm starting to understand. Thank you, Mrs. Setya.

Meanwhile, the misconception of the concept of temperature and the highest heat is in question number 4, where students think that the division of a substance of different sizes results in each part having a different temperature even though the correct concept is that the temperature of an object does not depend on the number or size of an object. This can be seen in figure 7 as well as the excerpt of the student interview.

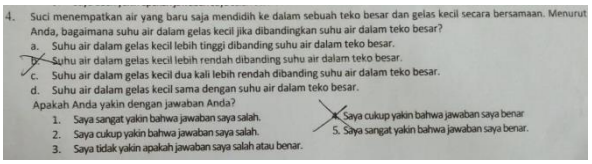
4. Suci menempatkan air yang baru saja mendidih ke dalam sebuah teko besar dan gelas kecil secara bersamaan. Menurut Anda, bagaimana suhu air dalam gelas kecil jika dibandingkan suhu air dalam teko besar?
a. Suhu air dalam gelas kecil lebih tinggi dibanding suhu air dalam teko besar.
b. Suhu air dalam gelas kecil lebih rendah dibanding suhu air dalam teko besar.
c. Suhu air dalam gelas kecil dua kali lebih rendah dibanding suhu air dalam teko besar.
d. Suhu air dalam gelas kecil sama dengan suhu air dalam teko besar.
Apakah Anda yakin dengan jawaban Anda?
1. Saya sangat yakin bahwa jawaban saya salah.
2. Saya cukup yakin bahwa jawaban saya salah.
3. Saya tidak yakin apakah jawaban saya salah atau benar.
4. Saya cukup yakin bahwa jawaban saya benar
5. Saya sangat yakin bahwa jawaban saya benar.

Figure 7. Answer sheet number 4

Interview excerpts:

Teacher : Nang, based on your answer no. 4. How do you understand the relationship between temperature and the size of objects?

Student : I think the temperature is greatly influenced by the size of the object, ma'am. For example, as in question number 4, the temperature of the water in the teapot is higher than the temperature in the small glass.

Teacher : Have you ever tried to measure it?

Student : Not yet, ma'am. It doesn't have a thermometer. Yesterday I also haven't tried practicum in class, ma'am.

Teacher : Okay, sorry. Tomorrow if we have time to prove it. While the explanation is this, the size of the object actually does not directly affect the temperature. So whether you want to be in a large teapot or in a small glass if the water poured is the same, yes, automatically the temperature is also the same.

Student : But why does the water in the big teapot feel hotter, ma'am?

Teacher : Good question, sip. This may be related to the size of the contact surface with our skin. When we touch the teapot,

more parts of our skin interact with larger objects, so we may feel a more intense sensation of heat. While small glasses have a smaller contact surface, so the sensation of heat can feel less intense.

Student : This must be proven, ma'am. Let me be more confident.

Teacher : Okay, ready. Next is on the agenda. But please keep in mind that scientifically, the temperature of the water in a large teapot and a small glass should be the same if they are in the same conditions.

Although learning has been designed in such a way, based on the test results given, it turns out that the number of students who do not understand the concept is quite large. This can be caused by the low interest of students in science subjects, especially in Physics material and students are used to only memorizing concepts so that newly learned concepts are not able to be understood. In addition, it can also be caused by students' low interest in learning, students have not been able to connect the initial concept with the new concept given, as well as the lack of talent and ability of students in understanding the material.

4. CONCLUSSION

Based on the test results, students are grouped into 5 categories, namely concept understanding (PK), not understanding concept (TPK), misconception (M), lucky guess (LG) and neutral (N). The percentage of students who understand the concept is only 49.8%, students who do not understand the concept by 5.7%, lucky guess students by 3.0%, students in the neutral category by 16.8% while students who experience misconceptions reach 24.7%. The highest percentage of misconceptions occurred in the concept of temperature and heat, which was 34%.

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