

Profile of Students' Prevalent Misconception on Classification of Materials and Its Properties

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Abstract. This study aimed to determine the level of student prevalent misconception on the topic of classification of materials and its properties. The study was conducted in SMP Negeri 3 Surakarta using purposive sampling technique with consideration of the highest average learning outcomes class was in VII 8. The method used in this study was descriptive analysis design with data collecting using test and interviews. Data were analyzed using descriptive analysis. The results of this study indicate the level of achievement of students' misconceptions on the topic of classification of materials and its properties as many as 23% of students in the group understood the concept, 46% of students in the group did not understand the concept, and 31% of students in the misconception group. Students' prevalent misconceptions on the topic of classification of materials and its properties are seen in the indicators explaining the definition of elements, compounds and mixtures with a percentage of 59%, indicators distinguishing physical and chemical changes by a percentage of 37% and on indicators distinguishing homogeneous and heterogeneous mixtures with a percentage of 31%. The results reflect on the process of teaching and learning science at schools..

1. Introduction

Education is one of the most important elements in human development due to the challenges happen in global century. Quality education will produce quality human beings too. Quality science education is influenced by five aspects, namely understanding concepts, process skills, creativity, developing attitudes and using concepts in everyday life [1]. In producing quality education each education unit conducts learning planning, implementation of the learning process and assessment to improve the efficiency and effectiveness of graduate competency achievement. Therefore to be able to achieve the expected competencies, students must have a correct understanding of material concepts. One study of subjects that must be studied by high school students is Natural Sciences (IPA). Science is one element that has an important role in the process of development and progress of science and technology. The aim of science learning is that students have the ability to develop curiosity, positive attitudes, and awareness of the relationship between science and technology, environment and society [2]. Science as a whole is complex concepts. Quite often these concepts are interrelated with each other. The problem that often arises is that students have difficulty in understanding science concepts correctly. These difficulties can cause students to experience misconceptions. Misconception is the understanding of concepts contained in the minds of students that are contrary to scientific concepts, which are influenced by the experience of students [3]. Teachers must be sensitive to misconceptions that occur to students so that teachers can design effective learning processes to overcome these

misconceptions, thus misconceptions must be identified so that actions can be taken to help students replace them with more scientific concepts [4]. Although misconceptions are difficult to eliminate, but if they can be identified early, prevention can be made and correct misconceptions [5]. One way that can be used by teachers to detect misconceptions that occur in students, then a multiple choice test is given. Multiple choice tests are also called multiple choice tests, namely tests given with several alternative answers [6]. One example of an evaluation instrument for detecting misconceptions is a two-tier multiple choice evaluation instrument. The two-tier multiple choice question instrument was developed by Treagust [7]. The two-tier multiple choice question form consists of two levels of questions, the first level is the content of the question which has two alternative answers and the second level is the reason for the answer chosen on the basis of the first choice. However, the two-tier multiple choice question form has a weakness because it is not always appropriate to distinguish students who understand concepts, misconceptions, and do not understand the concept especially for students in Indonesia who have the characteristics of lacking confidence in answering questions. Therefore, to overcome these weaknesses, CRI (Certainty of Responses Index) technique was developed which was developed in the development of multiple choice test questions. The CRI technique was developed by Hasan [8]. CRI (Certainty of Responses Index) is a technique of measuring the level of confidence or certainty of respondents in answering each question given. The importance of CRI is because CRI can distinguish students who know concepts, don't know concepts, and misconceptions.

2. Experimental Method

This study was conducted in the second semester of the school year 2018 / 2019. The samples in this study were class VII 8 which was determined based on the random sampling technique. Samples are determined based on certain considerations where the class is a superior class with the highest average learning outcomes. Data were analyzed using descriptive analysis integrated with data in the form of the percentage of students who experienced misconceptions for each sub-concept of classification of materials and its properties and interviews with students who had the misconception. Sources of data in this study are primary data because data is obtained directly from the research subjects. The study was conducted by giving a test using multiple choice diagnostic test instruments with CRI (Certainty of Responses Index) to students to get initial information about misconceptions on the topic of classification of materials and its properties. Multiple choice diagnostic test instrument with CRI is used to identify the pattern of students' misconception. Before the test is given to students, the test must be tested for validity and reliability. Based on the results of validity using Moment Product Correlation, there were three invalid questions, so they must be discarded. While the reliability results using alpha formula has been obtained and the number of reliability is 0.67. The results showed that the questions are reliable and ready to be used as data collecting.

3. Result and Discussion

3.1 Results

Table 1. Percentage of Students' Prevalent Misconception on Classification of Materials and Its Properties

No.	Category (%)		
	Understanding Concept (UC)	Misunderstanding Concept (MC)	Misconception (M)
1	9	66	25
2	19	25	56
3	19	75	6
4	3	44	53
5	9	47	47
6	13	6	81

7	19	47	34
8	19	75	6
9	38	47	16
10	13	69	19
11	44	34	22
12	31	53	16
13	9	59	31
14	31	22	47
15	22	47	31
16	13	53	34
17	84	9	6
Mean	23	46	31

3.2 Discussion

Table 1 presents the conception of class VII students of SMP Negeri 3 Surakarta on the topic of classification of materials and its properties. The percentage of understanding the highest concept lies in item number 17 by 84% while the percentage of not understanding the highest concept lies in item number 3 by 75% and the highest percentage of misconception lies in item number 6 at 81%. The average percentage of students who understand the concept is 23% and those who do not understand the concept are 46%, and those who experience misconceptions are 31%. The percentage that understands the concept is low because the percentage of students who understand the concept is less than 60%. The low level of understanding of the concept of students may be due to two things, namely students who do not understand the concept or students experience misconceptions. Some of the factors causing misconception include the students themselves, textbooks, teachers and teaching methods [9].

Based on the research that has been done, the results show that effective CRI instruments are used to describe the initial profile of students' conception by distinguishing students who understand the concept, do not understand concepts and misconceptions. This is in line with the research conducted by A'yun [10] which states that CRI can be used to explain students' conceptions of categories that understand concepts, do not understand concepts and misconceptions on the material structure of atoms. CRI is also effective in identifying prevalent misconceptions in students [11].

Furthermore, the initial profile of students' prevalent conception can be connected with indicators. The initial profile of students' conception based on indicators can be analyzed by looking at the average percentage of conception per indicator. The percentage of conception based on indicators can be seen in Table 2 below. The table explain based on each indicator and understanding level.

Table 2. Percentage of Students' Conception Based on Indicators

No.	Indicator	Item	Category (%)		
			Understanding Concept (UC)	Misunderstanding Concept (MC)	Misconception (M)
1	Explaining the definition of elements, compounds and mixtures	2	19	25	56
		4	3	44	53
		5	9	44	47
		6	13	6	81
		Mean	11	30	59
2	Distinguishing elements, compounds and mixtures	3	19	75	6
		7	19	47	34
		Mean	19	61	20
3	Determining the characteristics of elements (chemical and physical)	1	9	66	25
		17	84	9	6
		Mean	47	38	16

4	Distinguishing physical and chemical changes	14	31	22	47
		15	22	47	31
		16	13	53	34
	Mean		22	41	37
5	Explaining the definition of homogeneous and heterogeneous mixtures	8	19	75	6
		9	38	47	16
		10	13	69	19
	Mean		23	64	14
6	Distinguishing homogeneous and heterogeneous mixtures	11	44	34	22
		12	31	53	16
		13	9	59	31
	Mean		28	49	23

Based on the Table 2, it can be seen that the average student still has difficulty in understanding the material on the topic of classification of materials and its properties. This can be seen still the low level of understanding of students towards the material. In addition, some also experienced misconceptions about several indicators of the questions presented based on sub-chapter on classification of materials and its properties. In this case, the highest percentage of misconception lies in the first, fourth and sixth indicators with the percentage of 59%, 37% and 31% respectively.

3.2.1 Explaining the definition of elements, compounds and mixtures

This indicator lead to the highest percentage of misconception which is 59%. Students experience into a misconception if the answer is wrong but with a confidence level or CRI index > 2.5 . It is known that students have not been able to understand the indicators explaining the meaning of elements, compounds, and mixtures because during this time students tend to only memorize. The misconception shows that there are students who have not been able to explain the meaning of elements, compounds and mixtures. This is also in line with Tuysuz research [4] stating that the concepts explain elements, compounds and mixtures as much as 52% of students still experience misconceptions. Students assume that between elements and compounds is the same thing, they are confused about the concept because in the book they are using there are sentences that make students experience misconceptions in distinguishing between elements and compounds, namely in terms of compounds, meaning a single substance that can be broken down into two or more simpler substances. This understanding indicates that compounds with elements are the same, namely the same-single substance together, this is what often makes students experience misconceptions in distinguishing the two. To make students not confused in distinguishing it, it can be written that elements are substances that cannot be broken down into simpler substances, while compounds are substances that consist of two or more elements [12], so that by removing a single word from the previous understanding can make students understand more.

3.2.2 Distinguishing physical and chemical changes

In this indicator, students who experience misconceptions are 37%. From this percentage indicates that students are still wrong in distinguishing between events of physical and chemical change. Misconceptions occur because students assume that all changes in the form of substances produce new substances even though this is not true because the changes in the form of substances - the constituent elements remain the same as the original substances, but only change their form. After seeing the location of the misconceptions in this indicator section, the researcher then looked at the contents of the book in the sub section of the physics and chemical changes. It is known that the contents of the material in it are good because they are presented with experiments that require students to conduct the experiment, so the learning process has gone well because here students experience their own learning experiences. It's just that here it is not explained as to the process of changing matter includes physical changes. Students are sometimes still confused about the concept, they assume that the evaporating

process is a change in the form of a substance from water to steam. Students argue that water and steam here are different substances, whereas between water and steam here are the same substances, namely water, it's just a different form, one in the form of a liquid while when it has undergone the process of evaporation into gas. The separation of students who understood and did not understand appear here.

3.2.3 Distinguishing homogeneous and heterogeneous mixtures

For indicators to distinguish homogeneous and heterogeneous mixtures, based on the results of the test it is known that the percentage of misconceptions is 31%. This indicates that there are some students who still experience misconceptions on these indicators. Based on research conducted by Tuysuz [4], in this section approximately 34% of students still experience misconceptions. The cause of the misconception in this section is because the learning resources are lacking and the teachers' explanation is not clear in that section. The location of misconceptions that occur here based on interviews with students is that students are still confused in distinguishing between homogeneous and heterogeneous mixtures, as one example of the wrong concept here is that the mixture of water and salt is a suspension. Suspense itself belongs to a heterogeneous mixture. This is the reason students answer why a mixture of water and salt includes suspense because both are composed of solid and liquid substances. This is certainly wrong because even though it is composed of solid and liquid substances, a mixture of water and salt is a homogeneous mixture because the substances are not able to be seen again, distinguished or differentiated. For example, if the amount of sugar is dissolved in water and stirred well, then the mixture will basically be uniform (equal) in all parts so that it can be called as mixture [13].

4. Conclusion

The results of this study indicate students' prevalent misconceptions on the topic of classification of materials and its properties as many as 23% of students in the group understood the concept, 46% of students in the group did not understand the concept, and 31% of students in the misconception group. Students' prevalent misconceptions on the topic of classification of materials and its properties are seen in the indicators explaining the definition of elements, compounds and mixtures with a percentage of 59%, indicators distinguishing physical and chemical changes by a percentage of 37% and on indicators distinguishing homogeneous and heterogeneous mixtures with a percentage of 31%.

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