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Identification of Student Misconception using a Three-tier Diagnostic Test on Colloid

***Ratman, Nurafni, Kasmudin Mustapa, Minarni R. Jura, Nurida & Nurasiah**
Program Studi Pendidikan Kimia/FKIP – Universitas Tadulako, Palu – Indonesia 94119

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Abstract

This study aims to identify the percentage of misconceptions that occur in students on colloid material in class XI MIPA 2 SMA Negeri 1 Dampal Selatan Kab. Toli-Toli is based on the results of a three-level diagnostic test and shows which subconcepts have the highest and lowest conceptions. The instrument used in this study was a three-level multiple choice diagnostic test. The results showed students' misconceptions about colloid material in class XI MIPA 2, which was 65.51%. The results of this study indicate that the level of students' misconceptions about colloidal material is a high category.

Keywords: Misconceptions, three-tier, colloid

Introduction

Students' thinking ability in understanding each subject matter will be a benchmark in the success of the teaching and learning process. Each science has its level of understanding in understanding the material, one of which is chemistry which has a relatively high level of understanding (Komariyah & Laili, 2018). Chemistry is a science in which the study of facts, theories, principles and laws, scientific findings, and scientific work (Kurniasih & Rahayu, 2017).

One of the goals of learning chemistry is that students must be able to master concepts and be able to connect between ideas that have been studied. What is being studied and what will be explored so that many high school students still have difficulty learning chemistry material (Khotimah et al., 2016).

One of the causes of students' difficulties in learning chemistry is the lack of ability to connect concepts. It makes students often interpret ideas they feel are difficult according to the concepts they already have. However, sometimes the results of the students' interpretations themselves do not match the concepts that have been found by experts or the ideas that have been set, causing misconceptions (wrong conceptions) (Khotimah et al., 2016).

A misconception is a concept or cognitive structure that is inappropriate or deviates from the idea found by experts so that it can result in the students themselves and the teacher. Misconceptions usually come from students' experiences or initial concepts embedded in the minds of students who misinterpret the concept (Qadri et al., 2019).

Misconceptions that occur in students can be known by diagnosing misconceptions, so we need a tool or test that can measure student diagnostics. A diagnostic test is one of the tools that can be used to find out the problems or difficulties experienced by students, and this diagnostic test can be used to plan things to solve further issues that have been identified (Shalihah et al., 2016; Azura et al., 2017).

The three-tier diagnostic test has three levels: the first level of choice of answers, the second level is the reason for choosing the solution, and the third level contains confidence in choosing the answer (Rukmana, 2017).

The results of research by Dj et al. (2015), based on student learning styles, students' misconceptions on colloidal material with assimilation, divergent, and convergent learning styles are 18.4%, 18.63%, and 18.52%, respectively. Furthermore, in Utama (2018), as many as 28% of students experienced misunderstandings on colloidal material with a low understanding category. Factors causing students to experience misunderstandings come from students, teachers, and learning resources (LKS) (Nurhujaimah et al., 2016; Abbas et al., 2016).

Methods

The method used in this research is descriptive quantitative research. The descriptive analysis describes the conditions by explaining the findings obtained during the investigation (Shalihah et al.,

*Correspondence:
Ratman
e-mail: ratmanut@gmail.com

2016). In this study, researchers used a measurement technique as a three-tier diagnostic test. This three-level test measures the level of misconceptions about certain concepts. The population in this study were all students of class XI MIPA SMA Negeri 1 Dampal Selatan Kabupaten Tolitoli with 170 students who are divided into four classes, namely MIPA 1- MIPA 4 who are registered in the 2019/2020 school year. The sample used in this study was 29 students of class XI MIPA 2, consisting of 11 boys and 18 girls, with an age range of (14-15) 3 0 people, (16-17) 25 people, and (18-19) 1 person.

Sampling technique

The technique used in this research is by using the purposive sampling technique (selection based on consideration). The review made by the researcher is by looking at the student's interest in learning and the learning outcomes obtained by the students. The class with the lowest interest and learning outcomes is class XI MIPA 2 SMA Negeri 1 Dampal Selatan, which will be given a three-tier test.

Research instruments

The research instrument is a measuring instrument used in collecting data or information that can answer the problems of the research. The tool used in this study is a three-tier test consisting of three levels, the first in the form of common multiple choice questions and the second in the form of reasons for choosing answers on the first level test. The third level is in the form of confidence in selecting the solution on the first and second levels.

Data analysis technique

Techniques in analyzing the data collected by researchers need to take several steps, namely:

1) Analyze students' answers from multiple choice test results, reasons, and students' beliefs in choosing solutions that are adjusted to the level of understanding category on the three-tier test
2) Grouping student answers into categories of students who understand concepts, misconceptions and do not know concepts
3) Calculating the percentage of misconceptions experienced by students in the given questions
4) Making conclusions from the data obtained in the form of the percentage of misconceptions experienced by students on colloidal material

Three-tier result data can be analyzed descriptively in categorizing students' understanding (Madukubah et al., 2018). The analysis is carried out following table 1 to determine students who understand concepts, misconceptions and do not know ideas, using the following formula:

$$P = \frac{S}{J_s} \, x \, 100\%$$

description:

P = percentage of students who understand the concept, do not know the idea, and have misconceptions (false positive and negative fax).

S = the number of students who understand the idea but do not know the concept and misconceptions (incorrect positive and negative fax).

Js = the total number of students taking the test.

The next step is to categorize the level of students' misconceptions based on the grouping of Istighfarin et al. (2015), namely high, medium and low categories.

Results and Discussion

Student answer results

Based on the research results, the data obtained from student answers per question can be seen in **Table 1**. It can be seen that of the 29 students who were used as research subjects. Data on the number of students who answered the Three-tier diagnostic test questions were obtained based on grouping understanding concepts, misconceptions, and not understanding concepts. Furthermore, the percentage of students' answers to the diagnostic test questions can be seen in **Table 2.**

Identify misconceptions

The identification tests showed that the percentage of students who understood the concept as a whole was, on average, 6.89655, students who experienced misconceptions were 65.51724, and students who did not understand the concept 27.58620. The data was obtained by calculating the total number of students divided by the total number of students who took the test and multiplied by one hundred percent, so the average percentage of students who understood, misconceived, and did not understand would be obtained. Harizah et al. (2016) showed a high percentage of previous misconceptions in each given question.

Table 1. The results of student answers per item

Question	Number of Students Understand the Concept	Number of Students' Misconceptions	Number of Students Who Don't Understand the concept	Total number of students
1	3	21	5	29
2	7	16	6	29
3	7	8	14	29
4	4	2	14	29
5	2	15	12	29
6	3	15	11	29
7	2	16	12	29
8	15	5	8	29
9	16	10	3	29
10	7	13	9	29
11	4	17	8	29
12	4	15	10	29
13	8	10	11	29
14	4	11	14	29
15	10	12	7	29

Table 2. Percentage of student answers

Question	Understand the concept (%)	Misconception (%)	Don't Understand concept (%)
1	10.34	72.41	17.24
2	24.13	55.17	20.68
3	24.13	27.58	48.27
4	13.79	6.89	48.27
5	6.89	51.72	41.37
6	10.34	51.72	37.97
7	6.89	55.17	41.37
8	51.72	17.24	27.58
9	55.17	34.48	44.82
10	24.13	44.82	31.03
11	13.79	58.62	27.58
12	13.79	51.72	34.48
13	27.58	34.48	37.93
14	13.79	37.93	44.82
15	34.48	41.37	24.13
Average	22. 064	42.754	35.169

The questions that represent students' understanding of colloidal systems are questions number 1, 2, and 3. The percentage of misconceptions from the three questions is very high, 27.58%-72.41%. The highest percentage of misconceptions is found in question number 1, with a value of 72.41%. The high percentage shows that students have several patterns of misunderstanding. Most students consistently develop their misconceptions of science by accident. Misunderstandings are formed from everyday experiences, making them difficult to fix (Faizah, 2016).

The question that represents the highest level of misconception is question number 1, which is 72.41%. Question number 1 at the first level, many students answered that blood is a liquid in a solid because students think blood is a liquid, but if the blood is allowed to stand, it can become solid (thickened), so students assume that blood is a liquid in a solid. Because blood is a particle of the sole of red blood grains in blood plasma, blood is solid in a liquid (Yazid, 2015). It can be identified that the students' conceptions start from an inappropriate initial concept other than the teaching method used (Setiawan et al., 2017).

The question that represents the highest level of conceptual understanding is question number 9, with a value of 69.56%. Because basically, students are focused on memorizing the concepts described in the book. Problem number 9 is an example of a colloidal dispersion system divided into dispersed and dispersing phases. On average, students answered correctly on question number 9 because students memorized the material in the book. Holt (2016), in his book, said that students generally learn by reading and memorizing the material in the book, but they do not understand what they read and know.

The percentage of not understanding the concept is found in questions 3 and 4, amounting to 48.27%. It is due to the lack of students' understanding of colloidal properties in their daily lives. The teacher's teaching method is one of the

causes of the emergence of misunderstanding of concepts in students (Irsanti et al., 2017; Dyanti & Raharjo, 2018). Based on research conducted by Nurhujaimah et al. (2016), students tend to feel bored and sleepy when the learning process takes place. Only memorize material in books and other things that cause a lack of understanding in class XI students of SMA Negeri 1 Dampal Selatan Kabupaten Tolitoli.

Conclusions

Based on the results of the research that has been done, it can be concluded that the overall percentage of students at SMA Negeri 1 Dampal Selatan Kabupaten Tolitoli who have misconceptions about colloidal material is 65% with high criteria. The highest percentage of misconceptions is found in the sub-material of colloidal properties in daily life, with a value of 45.315%. Meanwhile, the lowest level of misconception is located in the sub-material of the role of colloids in everyday life, amounting to 34.48%. Regarding the percentage of misunderstandings based on item items, the highest percentage of misconceptions is in question 1, with a value of 72.41%. The lowest level of misunderstanding is found in questions 8 and 9, which is 55.17%.

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