

Analysis of Students' Understanding in Learning Chemistry about Solubility

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ABSTRACT: Solubility is one of the subject that students commonly find to be problematic, developing a wide range of alternative conceptions. The purpose of this study was to describe chemistry learning process and identify the students' understanding about concepts of solubility. Two tier diagnostic test were used to identify student's conception. The questions were given to students in grade XI one of the schools in Padang city. The results showed that there are many misconceptions about concepts in this subject. 61% of students experiencing misconceptions about the concept of the effect of ion namesake, 54% of the saturated solution concept, not yet saturated and superheated and 58% about the concept of the precipitation reaction. Student misconceptions and misunderstandings caused by teachers and students. Based on the observation of the learning process estimated misconception occurs because 1) the teacher did not review the prior knowledge of students, 2) learning methods are still traditional, 3) the teacher are less able to motivate students. Interviews with students can be concluded that the misconception occurs due to lack interpret student learning materials (memorized). so that the acquired knowledge is easily forgotten.

KEYWORDS: chemistry learning process., students' understanding , diagnostic test

1. INTRODUCTION

Learning is a process of building knowledge. Learning is the active process, where students construct their own knowledge. Students find their own meaning they learn. This is the process of adjusting concepts and new ideas with the framework that already exists in their minds. Learning is an internal process that occurs in a person's cognitive structure. That internal process in the form of construction of concepts to form a conceptual scheme called knowledge, where knowledge is the interaction between individual and environment continuously [6]. The concept formed is the basis for a person in building his new knowledge. Constructivist paradigm views the student as a person who already has the ability before learning something. The early capability will be the basis for constructing new knowledge [8]. Teacher help to make the process of students construction of knowledge running smoothly. Because students construct their own knowledge, it is not uncommon that the construction results did not match to the scientists [8], This is called misunderstanding or misconception

Concept in chemistry is a concept that is tiered from the simple to the more complex concept. To understand the higher concept needs to be the correct understanding of the basic concepts that build the higher [3]. If students have misconceptions on the basic concepts, they also will be misconception on related concepts. In the process of learning, a teacher will try to create learning conditions that help students understand the subject matter presented. However, the fact that not all students are able to understand the subject matter well. Students' scores in science subjects are usually below expectation [5]. Misconceptions in students can be caused by a preconception has been obtained by students from the results of previous learning, experience, social interaction, the ability to think, students motivation and interests as well as readiness to learn. Most of the misconceptions created for education through the transfer of a misunderstanding of the teacher, or as a consequence of the teaching methods that are not true

Chemistry is a part of science consisting of a very broad facts, concepts, laws, principles, and besides that it also about calculation of chemical (Middlecamp and Kean, 1985: 9). Therefore, students are required to have the capability of understanding the concepts and applying it to mathematical operations. Conceptual understanding is the understanding of issues related to the concept that is the meaning, nature and description of a concept and also the ability to explain the text, diagrams and phenomena. Problem-solving skills aligned with the ability to think mathematically. Some knowledge are related to that skill such as algorithmic problem, , linguistic,, schematics and problem-solving strategies (Kroll & Miller, 1993).

Solubility is the subject matter that involves understanding concepts and mathematical operations. In studying about this matter is expected that students have an understanding of the concept of equilibrium in the solution, the concept of solubility product constants, similar ions, pH, ionic equilibrium, the equilibrium solubility, a solution of saturated, unsaturated, oversaturated and the concept of the precipitation reaction.

The purpose of this study was to describe the students' understanding of the concept about the solubility. Understanding the concept expressed by the categories of understanding, misconceptions and do not understand. This descriptive study was conducted in two eleventh grade on one of the Senior High School in the district of Padang Pariaman. Each grade consists of 28 students. A phenomenon that will be revealed through this research is the process of learning and students' conceptions as a result of the learning process.

These two grades have the same ability level and taught by two different teachers. First class taught by teachers who have been teaching for seven years and holds a bachelor, while the second taught by a teacher who has teaching experience for 15 years and holds a postgraduate

Test and non-test techniques were used to collect the data. Two-tier diagnostic tests used to determine students' conceptions after learning process. Diagnostic tests are given in the form of multiple choice answer options along with three or four alternative reasons why students choose the answer

This test was first validated in terms of content validity. Content Validation is done to review the extent to which the contents of the test has been able to represent as a representative of the whole material that has been taught. Lecturer and chemistry teacher acts as validator. Observations carried out to observe the learning process of students in forming the conception of solubility. An interview was used to identify the causes of students' learning difficulties.

1. Data from the two-tier diagnostic test results processed by:

a. Grouping of students' answers. In this case the students were grouped into three levels of understanding that is understood, misconceptions, and no understand.

Table 1. *Categorization Criteria of Student Comprehension*

No	Level of understanding	criteria of understanding	
		First level	Second level
1	Understand	wright	wright
2	misconception	wright wrong	wrong wright
3	Do Not understand	wrong	wrong

(Source: Chandrasegaran, 2009: 15)

b. Using descriptive statistical analysis using percentages to determine the students' conceptions, with formula

$$\%answer = \frac{P}{N} \times 100\%$$

P =The number of participants in the group answers (understanding, misconceptions, or not understanding)

N = total number of participants

To determine the cause of misconceptions and do not understand, do a qualitative analysis by connecting two-tier diagnostic test results with the learning process and questionnaires given to students.

2. Interview

Interview were conducted to students to determine the cause of students' learning difficulties from that habit of student learning and the learning process in the classroom. Measurements using a Likert scale

2. RESULTS AND DISCUSSION

A. RESULTS

The findings of this study revealed how students' conceptions on learning about the solubility concept. These students' conceptions of this concept can be seen through the 16 items two-tier diagnostic test results are given. Each of these items represent the concepts included in solubility. The results of the diagnostic tests are grouped into three groups, namely the level of understanding Understanding (P), Misconception (M) and Not Understand (T). The percentage rate of students' conceptions on both classes shown in Figure 1,2 and 3

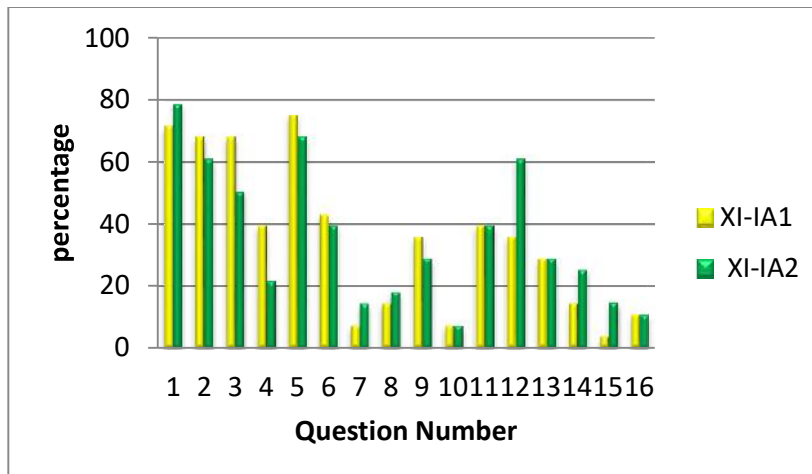


Figure 1. Diagram the percentage of students' who understand

Information :

Problem number 1,2,3 represents the concept of solubility product constants

Problem number 4,5,6, represents the concept Solubility

Problem number 7, 8 represents the ion equilibrium concept

Problem number 9,10 represents Effect of similar ion concept

Problem number 11, 12 represent the concept of the influence of pH

Problem number 13, 14, represents the concept of saturation solution

Problem number 15, 16, represents the concept of precipitation reaction

Figure 1 shows that the average student to understand in both classes do not much difference. The average level of students understanding of grade XI IA1 is 35.06% and grade XI IA2 is 35.37%. Problem No. 10 that is associated with the effect of similar ion proved to be a difficult problem for both classes. The concept of the precipitation reaction is also an elusive concept for students. Even only 1 (3.6%) grade XI IA were able to answer correctly

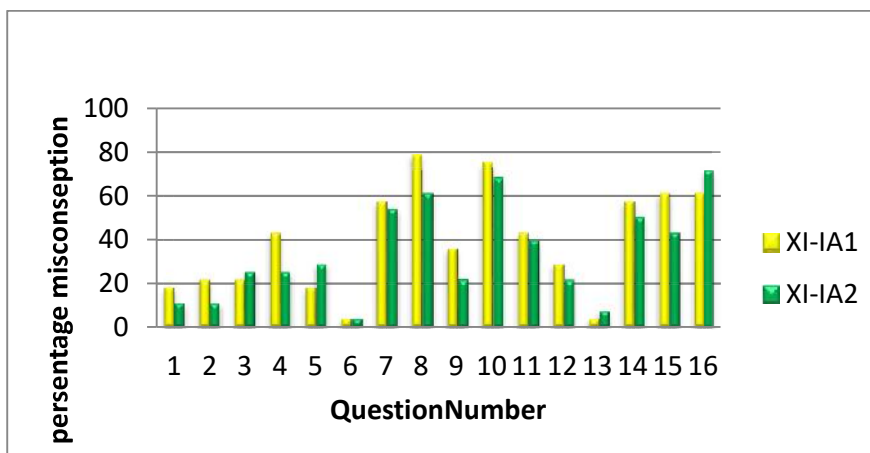


Figure 2. Diagram the percentage of students' who have misconception

Average misconceptions in grade XI IA1 is 39.07% and grade XI IA2 is 33.69%. The average for all tests, Grade XI IA1 experienced more misconceptions than the grade XI IA2 except question number 5 and 16.

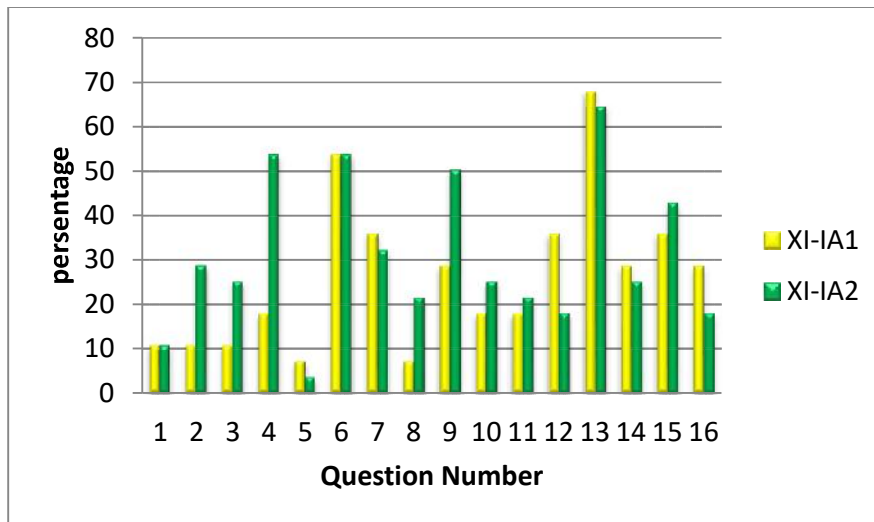


Figure 3. Diagram the percentage of students' who don't understand

25.87% students of grade XI IA 1 and 30.94% of grade XI IA2 are not familiar with a given diagnostic test item. In general, students who have misconceptions more than students who do not understand.

On average 25.87% of grade XI IA1 student and 30.94% IA2. Students are not familiar with a given diagnostic test item. In general, students who have misconceptions are more than the students who did not understand.

Table 2. Percentage of Students Level of Understanding

Concept	Item no	% understand		% misconception		% do not understand	
		IA1	IA2	IA1	IA2	IA1	IA2
• solubility product constants	1	71,4	78,6	17,9	10,7	10,7	10,7
	2	67,8	60,7	21,4	10,7	10,7	28,6
	3	67,8	50,0	21,4	25,0	10,7	25,0
• solubility	4	39,3	21,4	42,8	25,0	17,9	53,6
	5	75,0	67,9	17,9	28,5	7,1	3,6
	6	42,8	39,3	3,6	3,6	53,6	53,6
• Ion equilibrium	7	7,2	14,3	57,1	53,6	35,7	32,1
	8	14,3	17,9	78,6	60,7	7,1	21,4
• Effect of similar ion	9	35,7	28,5	35,7	21,4	28,6	50,1
	10	7,1	7,1	75,0	67,9	17,9	25,0
• the influence of pH	11	39,3	39,3	42,8	39,3	17,9	21,4
	12	35,7	60,7	28,6	21,4	35,7	21,4
• saturation of solution	13	28,6	28,6	3,6	7,1	67,9	64,4
	14	14,3	25,0	57,1	50,0	28,6	25,0
• Precipitation reaction	15	3,6	14,4	60,7	42,8	35,7	42,8
	16	10,7	10,7	60,7	71,4	28,6	17,9
Total		560,7	565,9	624,8	539,1	414,4	463,1
• average		35,06	35,37	39,1	33,69	25,87	30,94

3. DISCUSSION

5. students' understanding of the solubility

Misconceptions and not understanding in this matter because of students do not understand the shift of equilibrium concept has been learned in the last semester. There are several factors that cause an equilibrium shift. These factors are, concentration, temperature, pressure, and a catalyst. For Question 1, the dominant factor affecting the equilibrium shifts are concentration, whereby if concentration of product be enlarged, the equilibrium will shifted toward reactant and concentrations of the product to be reduced and vice versa. Based on the analysis of the learning process on both class, the teacher ever gives examples of questions that are almost exactly the same as diagnostic tests were given. But teachers did not explain the reason why the greatest solubility happen in pure water. The cause of misconceptions and do not understand also comes from the students themselves, where students assume that the greater the rank attached to a number, it will make large value regardless of its negative sign. Students also had difficulty in determining the concentration of compound, so that students also had difficulties in determine how many of these compounds are soluble. Students assume that the concentration of the compound equal to twice solubility price of compound. It is derived from the number two being coefficients of cations, while the figure is only required two to seek solubility of compound. solubility product constants

The cause of the students misconceptions and did not understand sourced on the coefficients in the Ionizing reaction. Supposedly this coefficient be promoted to gain solubility product constants. This is in accordance with a defined of solubility product itself that is the product of the concentrations of ions constituent a compound that is raised to the coefficient. In fact, students who have misconceptions and do not understand, did not raise to the concentration of ions with a coefficient, so they get the wrong results in its calculations. Students also do not understand the effect of the dilution on the solubility a compound.

6. Ion equilibrium

Students assume that if a solution added solven, it causes the diluted solution, the solubility of the compound in the solution will be greater. Supposedly, if a solution diluted, the solubility of the compound in the solution will remain. Likewise with constant product solubility Teacher did not explain the dilution factor affecting solubility.

7. Effect of similar ion

The percentage of students who understand this concept in both classes is low. To question number 10, only two students in each classroom who answered correctly. Most students did not answer the question about this concept

8. The influence of pH

Many students are hesitant about conversion solution pH to the concentration of each ion being components. Students are also difficulties in converting pH of the solution to a concentration of the solution and the ions

9. Saturation of solution

To determine whether the solution is classified as an unsaturated, saturated, or supersaturated, can identified through comparison of the numbers of solubility product constant (K_{sp}) of the compound to the product of the concentration of ions (Q) compiler compounds in the solution. In these two problems, after analyzing the students answers, students tend to choose the solution that is formed is unsaturated solution. This is because the students were make mistake in deciding the concentration of the solution formed. As a result, students are also difficult in determine the concentrations of the constituent ions and students gave the answers that are not appropriate. This misconception was caused teachers do not explain how the criteria of the solution can be categorized into a solution of unsaturated, saturated and superheated based on value comparison K_{sp} and Q value

f. Precipitation reaction

Many students who do not understand the concept of sediment or precipitat This concept is related to the concept of unsaturated, saturated and supersaturated solution. Judging from student answer sheet on diagnostic tests, it turns out many students who do not answer the given problem. Some Students try to make steps to get the true answers, but they did not finish their work

4. CONCLUSION

Many students who have misconceptions and did not understand the solubility. The cause of misconceptions and did not understand generally sourced from students (thinking skills and students' motivation is still low). The cause of misconceptions and did not understand also sourced from teachers. Teachers do not pay attention to the initial concept of students, teachers do not create an atmosphere for the occurrence of meaningful learning, so that students obtained the information quickly forgotten, Teachers also did not clarify the formation of a student's knowledge after the learning process. Seeing the results of student learning, there are no significant differences in the impact of the educational background of teachers who teach.

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