

Analysis Science Process Skills Content in Chemistry Textbooks Grade XI at Solubility and Solubility Product Concept

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Abstract: The aim of this research was to determine the analysis of science process skills in textbooks of chemistry grade XI in SMA N 1 Teras, Boyolali. This research used the descriptive method. The instruments were developed based on 10 indicators of science process skills (observing, classifying, finding a conclusion, predicting, raising the question, hypothesizing, planning an experiment, manipulating materials, and equipment, Applying, and communicating). We analyzed 3 different chemistry textbooks that often used by teachers in teaching. The material analyzed in the book was solubility and solubility product concept in terms of concept explanation and student activity. The results of this research showed different science process skill criteria in 3 different chemistry textbooks. Book A appeared 50% of all aspects of science process skills, in Book B appeared 80% of all aspects of science process skills, and in Book C there was 40% of all aspects of the science process skills. The most common indicator in all books was observing (33.3%), followed by prediction (19.05%), classifying (11.90%), Applying (11.90%), planning experiments (9.52%), manipulating materials and equipment (7.14%), finding conclusion (4.76%), communicating (2.38%). Asking the question and hypothesizing did not appear in textbooks.

Keyword : Science Process Skills, Chemistry Textbooks, Solubility and Solubility Product

1. Introduction

Generalizing, chemistry curricula tend to put the subject first, and applications a poor second [1]. Chemistry is perceived by students as a challenging subject since it is difficult to construct the abstract concepts frequently encountered in the subject area [2]. Chemistry curriculum generally combines numerous abstract concepts in which they are the center of learning chemistry and any other disciplines [3]. Chemistry is the science subjects which includes three levels of representation, which are: (1) the macroscopic level, where the concept is shown in the form of the phenomenon, learning the subject, energy, or other things that can be observed. (2) the microscopic level, where the concept is showed in the form of molecules, ions, and atoms. (3) the symbolic level, where the concept is showed in the form of a formula, equation or modeling [4]. One of chemistry learning subject that includes three levels of representations is solubility and solubility product. This learning subject is very dominant in symbolic level, there are a

lot of calculations that require symbols and equations. It is abstract too, there is a visible phenomenon explanation. It can not be seen with the eye and can only be done with prediction. With a scientific approach, this learning subject can be suitable to apply, because it can direct students to have a science process skills.

Science process skills (SPS) is student's ability to apply scientific methods to understand, develop and find the knowledge [5]. According to other sources, science process skills is a specialized skill that simplifies the science of learning, enabling students to develop a sense of responsibility students in their own learning, improve learning provision, as well as teach them methods of research [6]. SPS is very important for students to develop science by using scientific methods in order to obtain a new science. In facts in chemistry learning at school, the student learns by memorizing the concept without knowing the meaning of the concept. They can not be able to apply the concept in the other field in chemistry or another field in science [7]. Indicators of science process skills are [8][9]:

Table 1. Indicators of Science Process Skills

No.	Indicators of SPS	Description
1	Observing	use senses to describe the observed object optimally
2	Classifying	the systematics are used to classify things based on certain conditions
3	Finding conclusion	interpret the observings to make conclusions from the data on record
4	Predicting	estimate based on data from observings
5	Raising question	asked for an explanation, about what, why, how, when, and where
6	Hypothesizing	reasonable estimate to explain an event or observing
7	Planning experiment	determining the tools and materials, variable, and determine the step of work /process data
8	Manipulating materials and equipment	skills to using tools directly
9	Applying	explain new events using a concept that has been owned
10	Communicating	inform the result of observings, prediction, and experimental to others

The result of other research explains that there was the influence of active learning to the developing the science process skills [7]. The skills were suitable for all fields of science, SPS could reflect the true behavior of scientists when solving the problems and plan experiments. SPS is one essence of thinking and research in science [6].

Based on the interview of teachers in SMA Negeri 1 Teras Boyolali, solubility and solubility product was a complex subject and required a good concept and calculation by students. In the learning of this subject also required activity in the laboratory. Based on that statement could be assumed that SPS could available in learning. However, the success of a lesson to develop the SPS influenced by models, methods, and learning

media. One of learning media that often used by teachers was textbooks [10]. The textbook was a book that gives the instructions in the principles a subject of study, any books used as the partial basis a course of the study [11]. Textbooks are designed for use in the classroom, carefully prepared by experts and include suggestions for good learning [12].

Based on the observation, the teacher always uses chemistry textbook in learning, especially for solubility and solubility product. Each chemistry teacher at that school had different chemistry textbook. Based that conditions, we analyzed SPS content in chemistry textbooks. Therefore, we investigated science process skills content in chemistry textbooks at solubility and solubility product that often used by teachers in 11th grade class of SMA Negeri 1 Teras Boyolali.

2. Method

This research was conducted in SMA N 1 Teras, Boyolali, Central of Java, Indonesia. It used a descriptive method. The instruments were developed based on 10 indicators of science process skills that showed on Table 1. We analyzed 3 different chemistry textbooks that often used by teachers in teaching as shown in Table 2. for solubility product concept in terms of concept explanation and student activity.

Table 2. Chemistry Textbooks that Often Used by Teachers

No.	Books	Title	Author
1	Book A	Kimia 1 Untuk SMA/MA Kelas XI	Ari Harnanto & Ruminten
2	Book B	Belajar Kimia Secara Mena	Das Salirawati, Fitria M.K, & Jamil S
3	Book C	Kimia Untuk SMA/MA Kelas XI	Michael Purba & Sunardi

3. Result and Discussion

In this research, we analyzed 3 different books (Book A, B, C) based 10 indicators of SPS, there were observing, classifying, finding the conclusion, predicting, raising the question, hypothesizing, planning an experiment, manipulating materials, and equipment, Applying, and communicating. The example for analyzed is shown in Table 3.

Table 3. Example for SPS Analyzed in Textbooks

Book's Code	Expression	SPS indicator	Explanation
B307.2.1	Perhatikan gambar dibawah ini! Gambar tersebut mendeskripsikan tentang proses pelunakan air sadah. Sekarang coba kamu terjemahkan gambarnya kemudian tulis kembali proses pelunakan air sadah dengan gaya bahasamu!	Observing Applying Communicating	Because this book makes the reader to observe the pictures. After that, the reader would apply the knowledge about the concept to the real case. This book wants the reader to communicate the concept by writing a report.

(Part: Student Activity)

Analysis of chemistry textbooks was divided based on concept explanation and student activity. It was to make research easier.

3.1. Science Process Skills in “Concept Explanation” and “Student Activity” of Chemistry Textbooks

On the concept explanation and student activity obtained the following results:

Table 4. Percentage of SPS Aspect which Appeared in “Concept Explanation” and “Student Activity” of Chemistry Textbooks

No	SPS Indicators	Book A		Book B		Book C	
		P	Q	P	Q	P	Q
1	Observing	-	√	√	√	√	-
2	Classifying	-	√	-	√	-	-
3	Finding conclusions	-	√	-	√	-	-
4	Predicting	-	-	√	-	√	-
5	Raising question	-	-	-	-	-	-
6	Hypothesizing	-	-	-	-	-	-
7	Planning experiment	-	√	-	√	-	√
8	Manipulating materials and equipment	-	√	-	√	-	-
9	Applying	-	-	√	√	√	-
10	Communicating	-	-	√	-	-	-
	Total	0	5	4	6	3	1
	Percentage (%)	0%	50%	40%	60%	30%	10%

P: Concept Explanation Q: Student Activity

Table 5. Frequency of SPS Aspect which Appeared in “Concept Explanation” and “Student Activity” of Chemistry Textbooks

No	SPS Indicators	Book A		Book B		Book C	
		P	Q	P	Q	P	Q
1	Observing	0	2	6	3	3	0
2	Classifying	0	2	0	3	0	0
3	Finding conclusion	0	1	0	1	0	0
4	Predicting	0	0	4	0	4	0
5	Raising question	0	0	0	0	0	0
6	Hypothesizing	0	0	0	0	0	0
7	Planning experiment	0	1	0	2	0	1
8	Manipulating materials and equipment	0	1	0	2	0	0
9	Applying	0	0	1	2	2	0
10	Communicating	0	0	1	0	0	0
	Total	0	7	12	13	9	1

P: Concept Explanation Q: Student Activity

3.2. Science Process Skills in All Parts of Chemistry Textbooks

The results of this research showed different science process skill criteria in 3 different chemistry textbooks. Table 6 explained that Book A appeared 50% of all aspects of science process skills, in Book B appeared 80% of all aspects of science process skills, and in Book C there was 40% of all aspects of the science process skills (Based on accumulating data "Concept Explanation" and "Student Activity").

Table 6. Percentage of SPS Aspect which Appeared in Chemistry Textbooks

No.	Indicator of SPS	Books		
		A	B	C
1	Observing	√	√	√
2	Classifying	√	√	-
3	Finding conclusion	√	√	-
4	Predicting	-	√	√
5	Raising question	-	-	-
6	Hypothesizing	-	-	-
7	Planning experiment	√	√	√
8	Manipulating materials and equipment	√	√	-
9	Applying	-	√	√
10	Communicating	-	√	-
Total		5	8	4
Percentage (%)		50%	80%	40%

Table 7. Criteria of SPS Aspect which Appeared in Chemistry Textbooks

Books	Percentage (%)	Criteria
Book A	50%	Medium
Book B	80%	High
Book C	40%	Low

Table 8. Frequency of SPS Aspect which Appeared in Chemistry Textbooks

No.	Indicator of SPS	Books			Total	Percentage (%)
		A	B	C		
1	Observing	2	9	3	14	33,33%
2	Classifying	2	3	0	5	11,90%
3	Finding conclusion	1	1	0	2	4,76%
4	Predicting	0	4	4	8	19,05%
5	Raising question	0	0	0	0	0,00%
6	Hypothesizing	0	0	0	0	0,00%
7	Planning experiment	1	2	1	4	9,52%
8	Manipulating	1	2	0	3	7,14%

No.	Indicator of SPS	Books			Total	Percentage (%)
		A	B	C		
	Materials and equipment					
9	Applying	0	3	2	5	11,90%
10	Communicating	0	1	0	1	2,38%

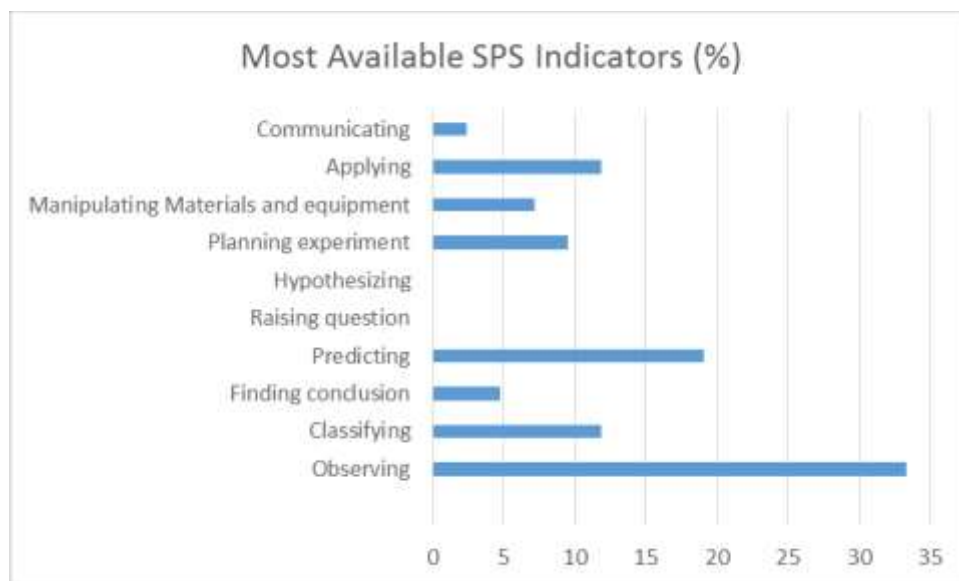


Figure 1. Most Available SPS Indicators

In Table 8 and Figure.1, it could be explain that the most common indicator in all books was observing (33.3%), followed by prediction (19.05%), classifying (11.90%), Applying (11.90%), planning experiments (9.52%), manipulating materials and equipment (7.14%), finding conclusion (4.76%), communicating (2.38%). Asking the question and hypothesizing did not appear in textbooks.

4. Conclusion

The conclusion of this research was the science process skills most appeared in Book B with an 80% of percentage (High Criteria). The most Indicators that appeared in each book was "observing" with 33.3% of percentage from the total frequency.

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