

The Science Process Skill Profile of Pre-Service Science Teacher

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Abstract—Having adequate science process skills is a must for pre-service science teachers as a provision in carrying out their duties as a science teacher. This study aims to provide a profile of the science process skills of pre-service science teachers in the Sciences Education Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Makassar. As the research subjects are students of science education study program during the sixth semester, the academic year 2017-2018 who were conducting the science school practicum. These research subjects were divided into two groups: 24 students from the ICP class and 31 students from the regular class. Data retrieval were conducted by giving a test of science process skill in the essay form that was filled out when carrying out an experiment. The data obtained were analyzed descriptively and obtained the results that in the ICP class, students received an average score of 3.7 with high category while in the regular class the average score was 4.0 also high category. In the ICP class, the highest score is the indicator of formulating the problem and explaining the tool and material while the lowest score is on the indicator of writing the variable operational definition. Furthermore, in the regular class, the highest score is obtained from the indicator of explaining the tools and materials while the lowest score is on the indicator of formulating the problem and writing the variable operational definition.

Keywords—*profile, science process skill, pre-service science teacher*

I. INTRODUCTION

The National Science Education Standard [1] states that the nature of science should be understood prospective teachers in six important parts, namely (1) science as inquiry, (2) content / content of science, (3) science and technology, (4) science in personal view and social, (5) the history and nature of science, and (6) integrating concepts and processes. From the essence, it can be understood that the essence of learning science is very broad including content, technology, inquiry, to the combination of concepts and processes. This is also in accordance with the statement [2] that learning science requires learning strategies, must enable mastery of scientific concepts with investigative skills through investigation and practical work.

The process of acquiring scientific information through inquiry is needed skills. One skill in scientific investigation is science process skills. Science process skill involves intellectual, manual and social skills that are used to build an understanding of a concept or knowledge and to convince the understanding that has been formed [3]. With Science

process skill, students can get concepts and knowledge stored in long-term memory.

Science process skills are the basis of scientific thinking and conducting research [4], [5]. Science process skill is defined as identifying problems, formulating hypotheses about a problem, making valid predictions, identifying and defining variables, designing experiments to test hypotheses, obtaining and analyzing data and presenting findings that support data [6], [7].

Having adequate science process skills is a must for pre-service science teachers as a provision in carrying out their duties as a science teacher. This study aims to provide a profile of the science process skills of pre-service science teachers in the Science Education Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Makassar.

II. METHOD

This research is survey research at students of science education study program at sixth semester, the academic year 2017-2018 who were conducting the science school practicum on optics material. These research subjects were divided into two groups: 24 students from the ICP class and 31 students from the regular class. ICP class is a class that uses two languages in the learning process while the regular class uses only one language.

Data retrieval were conducted by giving a test of science process skill in the essay form that was filled out when carrying out an experiment. The questions totaled 8 items with the maximum score is 5. Thus the maximum score that can be obtained is 40. The data are analyzed by descriptive statistics.

III. RESULT AND DISCUSSION

A. Result

Based on the research conducted, it was obtained the data of scientific process skill as below.

TABLE I. DATA OF SCIENCE PROCESS SKILL SCORE OF THE PRE-SERVICE SCIENCE TEACHER

No	Statistical Data	ICP Class	Regular Class
1	Sample	24	31
2	Maximum Score	40	40
3	Minimum Score	8	8
4	The Highest Score	37	39
5	The lowest score	21	20
6	Average score	29.7	32.2
7	Deviation Standard	4.3	5.5
8	Varians	18.9	30.7

From the data in Table 1, it appears that the average score obtained by ICP class is 29.7 while in the regular class is 32.2. Variation of data is looked at in the regular class which has the highest and the lowest scores, so the variance is greater compared to ICP class.

In addition to the total score data obtained for each prospective science teacher, then the data on the scores obtained by prospective science teachers for each indicator is presented. For the detail explanation from each indicator, it can be looked at the graph below.

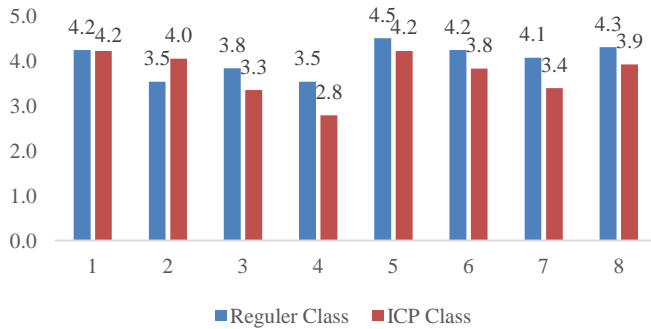


Fig. 1. Graph of the average Score of Science Process Skill for each indicator

Explanation:

- 1 : formulating research problems
- 2 : formulating hypotheses
- 3 : deciding variables
- 4 : writing an operational variable definition
- 5 : deciding tools and materials
- 6 : formulating the steps of the experiment
- 7 : writing experiment results
- 8 : writing conclusion

From the graph , it can be seen that both classes have the lowest score at indicator “write the operational variable definition.” The ICP class score with score 2.8 was lower than a regular class with 3.5 in this indicator. The highest score in both classes is on the indicator of writing the tools and materials. It appears that the prospective science teacher has the ability to remember the tools and materials to be used.

Furthermore, if we pay attention to the scores in each class, clearly explain that there are differences in skills possessed by both classes. ICP class has the highest score on the indicator determining the tools and materials that are score 4.5 followed by the indicator writing conclusions with a score of 4.3. The lowest score in this class is on the

indicator formulating the hypothesis and writing the operational definition of the variable that is the score 3.5.

In the regular class, the highest score is on the indicator formulating the problem and determining the tools and materials with a score of 4.2. For the lowest score, the indicator writes a variable operational definition with a score of 2.8. this score is the lowest score obtained when viewed from the data in two classes and all indicators.

By looking up to the categories of each average score, the indicators of science process skills can be seen in table 2. From Table 2 it appears that writing the operational definition of variables is at enough level and the others are already in the high and very high categories. Judging from the average of the two classes shows that the two classes are in the high category with scores of 3.7 and 4.0.

TABLE II. THE CATEGORIES OF AVERAGE SCORE BASED ON THE INDICATORS OF SCIENCE PROCESS SKILLS

No	An indicator of Science Process Skill	ICP Class		Reguler Class	
		Average Score	Category	Average Score	Category
1	Formulating research problems	4.2	Very high	4.2	Very high
2	Formulating hypotheses	4	High	3.5	High
3	Deciding variables	3.3	High	3.8	High
4	Writing operational variable definition	2.8	Enough	3.5	High
5	Deciding tools and materials	4.2	Very high	4.5	Very high
6	Formulating the steps of the experiment	3.8	High	4.2	Very high
7	Writing experiment results	3.4	High	4.1	Very high
8	Writing conclusion	3.9	High	4.3	Very high
	Average	3.7	High	4	High

B. Discussion

The results of the data obtained show that the average score of science process skills of prospective science teacher candidates is sufficient even though there are still only 50% of their abilities because they only have a score of half of the maximum score. Skill scores from both classes also vary. This shows that both classes have varied science process skills. However, there are also those who have similarities as in the indicator formulating the problem.

Why is it important to know and measure science process skills? From several studies obtained information that science process skills have a correlation with learning outcomes. A similar study was carried out by [8] that there was a correlation between science process skills and student learning outcomes of the biology department of Washington University. He mentioned that the lack of certain scientific process skills was a determining factor in the number of biology students who failed in several courses.

Therefore, science process tests become a necessity to measure the science importance extent as to intellectual

aspect of the learner, particularly prospective science teacher, and further is to measure its impact through being aware of the acquired skills; starting from observation and measurement, classification and prediction skills, reasoning and communication, data interpretation, procedural definitions, variables adjustment, hypothesis formulation accessing to trial skills [9].

Tests to measure science process skills using completed essays when conducting an experiment. In detail, the test results can be explained as follows.

1) *Formulating research problems*

The first indicator measured in this study is formulating the problem formulation in an experiment. In this study, the experiments conducted by prospective science teachers were experimenting on the light. Some of them choose light reflection experiments, and some choose light refraction. After determining the title of the chosen study, the candidate of the science teacher writes the problem formula.

Judging from the indicator score, the natural science teacher candidates generally have sufficient ability in formulating the problem formulation. They have been able to connect variables that are interrelated in an experiment. But even so, there are still some natural science teacher candidates who make mistakes. The error in question is an error in determining what variables are acting so that it is wrong to formulate the problem. As an example of the formulation of the problem that is made, "*what is the mirror relationship with the shadow?*" Even though they want to find the relationship between the type of mirror and the nature of the shadow.

2) *Formulating hypotheses*

After the pre-service science teacher formulates the problem formulation, then formulate the hypothesis. The acquisition of scores on this indicator looks lower than the indicator formulating the problem formulation. There are still some natural science teacher candidates who are wrong in answering the formulation of the problem or making a hypothesis. Skills in formulating hypotheses must indeed be based on prior knowledge. The relationship between variables is known through theory, and this is the shortage of prospective science teacher students because there are those who have not recognized the basic concept of reflection and refraction of light.

3) *Deciding variables*

The experimental variable is very visible if it is correct in formulating the problem formulation and writing a hypothesis. This indicator is very dependent on the previous indicators. Manipulation variables and written response variables on the previous indicator. The many mistakes that are made are wrong in determining the control variable. Students of natural science teacher candidates cannot determine control variables correctly.

4) *Writing the operational variable definition*

After determining and writing down the variables that will be used in the experiment, the prospective science teacher must write the operational definition of the variable. From the indicators of science process skills indicators, information is obtained that the indicators that have the lowest value both in the ICP class and the regular class are writing the operational definition of the variable. This low score is caused by a lack of understanding of the prospective

science teacher about the meaning of variable operational definitions. Many answers only write definitions of the variables of manipulation, response, and control. For example, there are answers that write like the following: "*Manipulation variables are variables that are changed in this experiment, namely distance objects.*" This is an example of the answers to prospective science teachers who choose to experiment with light. From these answers, it is very clear that they do not know how to make operational definitions of an experiment variable.

5) *Deciding tools and materials*

Most of the pre-service science teacher can write the tools and materials that will be used in the experiment. Some of them are able to describe in detail the optical devices used even though the tools and materials are small, for example, bulbs, cables, bows, and so on.

But even though some have been able to write down the tools and materials correctly, some are still writing not in detail, for example, only writing optical KITS. In the optical KIT, all the tools and materials for auto power experiments are complete, so this answer is not correct. The science teacher candidates should be able to write down in detail the tools and materials used.

6) *Formulating the steps of the experiment*

After determining the tools and materials that will be used then write down the experiment steps. Some students can already write in detail the steps to experiment with their own language. There are those who start from preparing the tools and materials, and some are directly starting from arranging tools and materials.

7) *Writing experiment results*

Errors in the indicator "write down the results of the experiment," affected by the error in the experiment. The results of the images or data obtained are not good. For example the image of a concave mirror experiment. The lines that come are not aligned with the main line, and the lines of the rays come sloping, so the reflection is not good. There are also experimental results from parallel lenses that only describe the light coming in and coming out of the lens then writing that the angle of the incoming beam and the refractive ray are the same. This is a fatal mistake because it cannot describe the incoming rays and refractive rays on a plan parallel lens.

As with formulating a hypothesis, writing the experimental results must have the concept of knowledge from what was experimented. Some IPA teacher candidates can make the experiment step correctly but cannot experiment properly.

8) *Writing conclusion*

Writing conclusions is the last indicator of the science process skills assessed in this study. Although it looks easy, there are still students who have not been able to write conclusions correctly. The formulation of the problem and the hypothesis does not become a benchmark in writing conclusions. So there are those who make conclusions not based on the formulation of the problems made beforehand.

The results of measuring science process skills are important information for lecturers in the science education study program. Skills that are still lacking can be improved by multiplying laboratory practicums that develop science process skills for prospective science teachers. Lab science

should facilitate students to develop their science process skills [10]. This is very important considering that they will teach science at school later.

IV. CONCLUSION

Based on the results of the study it can be concluded that the science process skills of prospective science teachers in both ICP and regular classes are in the high category. The lowest skill score is on the indicator "writing variable operational definitions" with enough categories. This is important information to emphasize more on how to understand natural science teacher candidates in making the variable operational definitions correctly.

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