Science Process Skill Ability Level of Senior High School Students in Learning Chemistry in Jambi

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Submission date: 28-Jun-2020 11:09AM (UTC+0700)
Submission ID: 1350634954
File name: IJSTR_Vol_9_4_2020_Anita_Asni_Maison_Rusdi_Rayandra.pdf (350.15K)
Word count: 3559
Character count: 18300

Science Process Skill Ability Level Of Senior High School Students In Learning Chemistry In Jambi

Anita Herda, Asni Johari, Maison, Muhammad Rusdi, Rayandra Asyhar

Abstract— The scientific steps in learning chemistry taken by students during a teaching and learning activity are very similar to what is conducted by scientists in the acquisition of scientific knowledge and are known as Science Process Skill (SPS). The skill is beneficial for the students not only in doing learning activities during the classroom process but also in solving real problems in daily life. That is why many countries today are addressing its educational policy in improving SPS of the students. The purpose of this study was to describe the science process skill characteristics of senior high school students in Jambi Province in terms of chemistry subject. The survey method used in this research involved 414 respondents of 11th-grade students (206 males, 208 females) of 16 schools in Jambi Province by using a test technique for data collection. The research results showed that the students' achievements of SPS for each indicator were 60% (observing), 29% (measuring), 64% (classifying), 51% (interpreting), 54% (making hypothesis), 46% (identifying), 70% (predicting), 40% (experimenting), 43% (concluding), 40% (communicating). Based on the research data, it can be concluded that the SPS level of senior high school in Jambi Province was categorized as low. Furthermore, there was no significant effect of gender on students' SPS ability with SPS levels of 48.7% for males and 49.1% for females, respectively.

Index Terms— ability level, basic-integrated, science process skills, senior high school.

1 Introduction

Today, human resource quality becomes a burning issue and an interesting theme of discussions in all countries over the world. Their governments are addressing the orientation of educational policy to the improvement of human resources quality. This can be understood because the skilled and qualified citizen is an absolute necessity in facing the challenges of the 21st century to be able to take part and survive in global competitiveness. Unskilled human resources are difficult to compete and to survive in this era with high competition. That is why improving human quality is an obligatory goal of all countries. To realize this goal education plays an important role. As one of the developing countries, Indonesia should be able to take part in the competition [1]. One of the thinking skills that is absolutely needed in the global era is science process skill (SPS). These skills are a process of thinking of the scientists in discovery and construction of knowledge to solve problems and formulate results [2] that occur naturally and spontaneously in our minds as we think individually, collectively and logically about how the world or nature works [3]. Arabacioglu and Unver [4] divided SPSs into basic and integrated skills. The basic science process skills provide a foundation for integrated skills. The basic skills include observing, inferring, measuring, and communicating, while the integrated include identifying, controlling variables, investigating, formulating hypotheses, testing and interpreting data.

According to [5] and [6] the basics are appropriate to be introduced to students of lower school levels, while the integrated skills are more suitable for higher education students. To improve the ability of students in SPS, it is essential for the teachers to train their students by doing experimental works and thinking scientifically during a teaching and learning process [7]. The steps in an experimental work are similar to what scientists performed in the acquisition of knowledge. Chemistry as science can also be used as a media to facilitate that scientific process to occur. The students who are already skilled in scientific thinking usually will have critical and creative thinking and problem-solving abilities. Thus, the quality produced in learning science is not based on the depth of the material being learned, but how scientific knowledge can be constructed and obtained meaningfully for students that are actualized in their daily life. Therefore, the national curriculum in Indonesia today is implemented by using a scientific approach. It is intended that the students are able to explore knowledge scientifically and not just be given directly by the teacher. Scientific knowledge that can be constructed by students, of course, must go through scientific activities as well. As a natural science, learning chemistry should not only be emphasized on the mastery learning, it is more important the students must be able to implement that knowledge creatively to solve problems that occur in the surrounding life [8], [9] with active involvement in the learning process [10], [11]. Thus, they are required to have a high literacy ability to search for information. The abilities acquired by students can be measured through observations, reports of experimental results and oral presentations [12]. In addition to processes and products, scientific attitude is one of the characteristics of science that plays an important role in character formation. Because the attitude that plays a role in the process is very important for students to have [13], [14]. Science process skills are also closely related to student motivation [15]. In order to be able to conduct appropriate programs and make proper decisions in education to face the global era, it is necessary to determine the ability level of students in SPS. Reports about the profile of SPS students' ability of secondary schools in Jambi city has been given by previous researchers [16]. The research data showed that the average ability of junior high school students' science process skills in Jambi city is still relatively low. In contrast to the result of research performed by [16], [17] reported that SPS characteristics of junior high school students in Tangerang in learning biology lie on category levels of sufficient to high. The development of junior

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school students' SPS has been reported by [18] using computer simulation as learning media. Continuing previous research, it is necessary to perform a survey to determine the SPS ability level of senior high school students in learning chemistry. The results obtained from this study will be able to complete the previous research data. Based on the abovementioned description, this study is focused on the scientific process skills of senior high students. This, the purpose of the research was to describe the scientific process skill ability level of senior high school students especially in Jambi Province. The research question that would be answered in this survey research was how the ability level of senior high school students in SPS in learning chemistry in Jambi is.

2 Research Method

The research design used in this study was a descriptive survey to reveal the characteristics of students' science process skills of senior high schools in Jambi Province, Indonesia. The subjects involved in this research were 414 respondents of 11th-grade students (206 male and 208 female) of Senior high schools (SMA) of odd semester academic year 2019/2020 in Jambi Province that was randomly selected. Data collection was carried out using a set of science process skill test instruments. Each respondent was given a package of test questions that was consisted of 20 items. The test instrument measured the ability consisting of ten aspects of the integrated science process skills, i.e. observing, measuring, classifying, making hypotheses, interpreting data, identifying variables, predicting, experimenting, concluding and communicating. Scores obtained by students were then categorized as very low, low, average, and high levels according to the following Table 1.

TABLE 1
SCORE RANGE AND CATEGORY OF STUDENT SCIENCE PROCESS SKILLS

Score range	Category
0-5	Very low
6-10	Low
11-15	Average
16-20	High

Percentage of the category is intended to find out the dominance of science process skill ability level of the students by using the formula:

$$\text{Percentage} = (X/n) \times 100\%$$

where
X: number of students in a category
n: number of total respondents

The percentage of values obtained are then categorized using Table 2.

TABLE 2
CATEGORIES OF STUDENT SCIENCE PROCESS SKILLS

Values (%)	Level Category
0 – 25	Very low
26 – 50	Low
51 – 75	Average
76 – 100	High

The data category and the percentage were used to conduct descriptive analysis to provide an overview and thorough in obtaining complete information about the science process skill ability level of students. The additional data obtained from interviews with selected students are also included for research completion.

3 Results and Discussion

3.1 Students' SPS Ability in General

The data listed in Table 3 describes the SPS ability of senior high school students, the respondents in this survey. Table 3 shows that 7 of 16 senior high schools have SPS scores above the average value, and most of them have the accreditation values of A and B. When compared the schools in the accreditation of A and B to other schools with the accreditation of C, it can be said that the students of the schools with higher accreditation value do not automatically have a high level of SPS. It is very interesting to discuss here is that there are two schools and which is accredited C (SC-12) and not accredited (SC-14) have higher scores than average, while the others have lower. This can be easily explained from the interview data given by respondents where the science teachers of these 2 schools are very creative in performing their teaching and learning activities. The teachers implement a variety of instructional models and strategies as well and use various materials available around the schools as media in order to conduct the science process in the classroom. However, there are only two senior high schools that show SPS students as being in the medium category. The overall SPS percentage of senior high school students can be seen in the following Figure 1.

TABLE 3
SPS ABILITY LEVEL OF SENIOR HIGH SCHOOL STUDENTS IN JAMBI PROVINCE

Code of School	Accreditation	The number of students	SPS Level of Students				Average SPS Value
			Very Low	Low	Average	High	
SC-01	A	34	0	9	19	6	12,6
SC-02	B	36	0	22	13	1	10,1
SC-03	A	30	0	17	12	1	10,2
SC-04	C	18	1	15	1	1	8,4
SC-05	B	21	2	13	6	0	9,2
SC-06	A	33	3	24	5	1	8,4
SC-07	C	21	2	13	5	1	9,4
SC-08	B	24	1	13	9	1	9,3
SC-09	A	38	3	18	15	2	10,2
SC-10	B	25	3	13	8	1	9,3
SC-11	C	17	0	11	6	0	9,4
SC-12	C	22	0	13	6	3	10,6
SC-13	-	21	1	14	5	1	9,5
SC-14	-	23	1	10	11	1	10,1
SC-15	B	26	0	13	13	0	11,0
SC-16	B	25	0	16	9	0	9,8
Total		414	17	234	143	20	157,4
Percentage		100	4,1	56,5	34,5	4,8	9,8

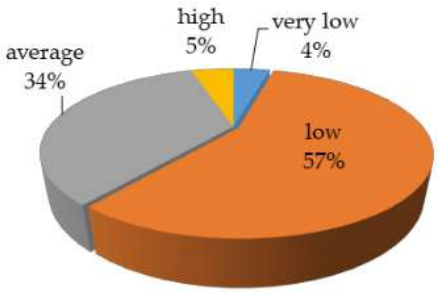

Fig. 1. Percentage of students' SPS ability in Jambi

Percentages of SPS students' ability level according to categorization presented in Figure 1. From Figure 1, it can be seen that the percentages of students in the category of very low, low, average, and high are 4, 34, 57, and 5, respectively with the average SPS is only 9.8. Thus, overall it can be concluded that the SPS of senior high school students in Jambi Province is still in the low. This is in accordance with the research conclusion reported by [16]. Many factors affecting this low achievement, such as the low ability of SPS teachers; lack of teaching materials that develop and improve student SPS and lack of guidance in developing SPS-based assessment tools for both teachers and students. Yet according to [19], one of the most commonly used thinking skills, besides emphasizing that individuals who cannot use SPS will experience difficulties in their daily lives [5]. This shows how important it is to be developed and owned by every student in senior high school.

3.2 SPS Level in Test Indicators

The next is to analyze the student's correct answers and group them into each aspect of SPS. To find out how far the SPS level of senior high school students is in Jambi Province for each element of SPS can be seen in **Figure 2**.

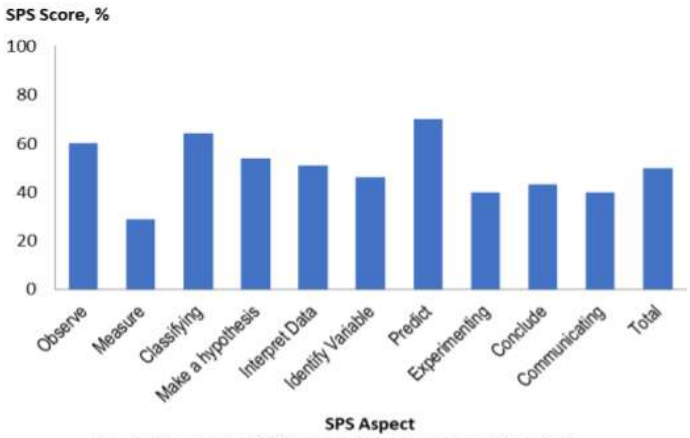

Fig. 2. The student SPS chart for each aspect of the SPS

Based on Figure 2, it can be seen that from the ten aspects of SPS tested in the test questions, there are only five aspects that appear in the medium category, and the rest are in a low category. SPS aspects of students that appear in the medium category are aspects of observing, classifying, making hypotheses, interpreting data and predicting. Whereas aspects of student SPS that appear in the low category are aspects of measuring, identifying variables, conducting experiments, concluding, and communicating. The low level of SPS in Figure 2 may be caused by a lack of practices in measuring during learning activities. Usually, measurement activities are dominated by active students. This shows that the SPS of senior high school students in Jambi Province for each aspect is generally in the low category, where the average student is only able to answer correctly as much as 49.7% of each aspect of the SPS being tested.

Based on the above data, it can be seen that the SPS of students, both basic SPS and integrated SPS is still low. This reinforces the results of research by [16], which states that the skills of students making conclusions, observing, predicting, measuring and classifying are still low. And research by [20] shows that the results of the basic SPS are in the middle category and integrated SPS in the low category and in general, students' science process skills are in the poor category.

3.3 SPS Level Based on Gender

To get a picture of students' SPS based on gender, the next analysis is to group students' correct answers based on gender and classify them into every aspect of SPS. For more details about SPS students by sex can be seen in Figure 3.

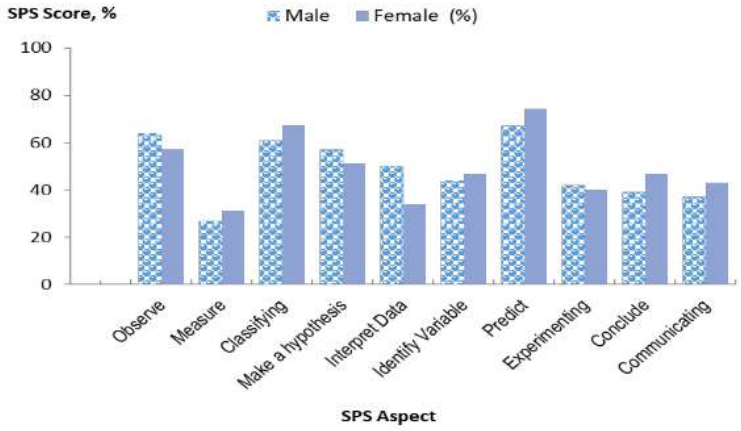

Fig. 3. Students' SPS by gender

Based on the table and figure, it can be seen that SPS male and female students in each aspect of SPS have a different number of percentages, but both have the same category. Both male and female students both have SPS in the medium category for aspects of observing, classifying, making hypotheses, and predicting. As for aspects of measuring, interpreting data, identifying variables, conducting experiments, concluding and communicating are in a low category. The average percentage of SPS of male and female students also showed results that were not too far apart, reaching 48.1% and 49.1%, respectively, and both were in a low category. Thus it can be seen that both male and female students have low SPS abilities. This shows that there is no gender effect on differences in the SPS level of students in Jambi Province. Although there is no significant difference, the ability of female SPS is higher than that of men when viewed from the percentage gain. This is in line with the results of research by Zeidan and Jayosi [21]. They found that there was

a significant influence between sexes and women's more dominating achievement. Thus we need a learning process that is able to foster and develop student SPS. Teachers are required to be able to design and create a learning process science that can develop their student SPS. So that both basic SPS and student integrated SPS can be improved. This is according to the opinion of which states that science process skills need to be developed through direct experiences as learning experiences. Because through direct experience, someone can better appreciate the process or activity that is being carried out.

4 Conclusion

Based on the results of research, it is concluded that the SPS level in the chemistry of senior high school students in Jambi Province is still low, where the average achievement for each indicator of 9.8. SPS's ability level of senior high school students in Jambi Province is still low, with a percentage of 49.7%. There is no gender effect on student differences because both male and female students alike have low SPS abilities, namely 48.7% and 49.1%, respectively. This low-level student certainly requires the teacher to be able to plan and carry out a science learning process that is capable of developing SPS of senior high school students. It is recommended that teachers design and develop learning strategies that accommodate students in learning chemistry. Strategies that are able to support students achieve aspects such as inquiry-based, problem-based learning, and other scientific learning. Thus, to achieve this optimally, students must be given assignments intangible forms and make them creative in solving complex problems in the form of inquiry.

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