THE ANALYSIS OF SCIENCE PROCESSING IN BIOLOGY OF X GRADE STUDENTS OF SENIORHIGH SCHOOL “Y” IN PONOROGO REGENCY

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THE ANALYSIS OF SCIENCE PROCESSING IN BIOLOGY OF X GRADE STUDENTS OF SENIORHIGH SCHOOL "Y" IN PONOROGO REGENCY

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Abstract

Science processing skills (SPS) is a psychomotoric ability in 2013 curriculum. The implementation of SPS can be done well in the planning or in the learning process. This research aimed to analyze X grade students' potentials of SPS in biology in senior high school "Y", Ponorogo regency. This research used descriptive qualitative research. The data in this research were collected from non-test way using observation and documentation. The learning process was analyzed using the instrument of SPS evaluation in eight aspects 1) formulating hypothesis, 2) planning experiment, 3) conducting experiment, 4) doing observation, 5) interpreting data, 6) predicting, 7) implementing concept, and 8) communicating. These aspects have four indicators. The analyzed learning process was in the material of Bryophyte and Pteridophye. The analysis of data was in descriptive quantitative. The results of the analysis were aspect 3) was 35.29%, aspect 4) was 23.54%, aspect 5) was 11.76%, aspect 6) was 11.76%, and aspect 8) was 17.65%. Based on the analysis, it can be concluded that X grade students' science processing skills in Senior High School "Y" Ponorogo regency has not been optimally used and in low category. It is suggested that there should be a planning and designing of practicum in the learning process.

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INTRODUCTION

Biology is a part of science which has different characteristics and terms to other disciplines. Characteristics and terms of biology influence its learning process. The learning process for Senior High School in this subject is according to 2013 curriculum. It means biology is taught using learning media which can give students' experience of cognitive, psychomotoric, and scientific learning. The objective of the subject is to develop students' cognitive, psychomotoric, and affective aspects which emphasizes on science processing skills (SPS).

Processing skills are skills which views that learning science should reflect how scientist work in their fields. Science processing skills can be defined as skills from mental, physical, and social ability which moves the students to higher level (Nuryani, 2010). It is in line to (Suciati, 2010), science learning emphasizes on SPS. It involves the aspects of cognitive (minds on), psychomotoric (hands on), and scientific behavior (hearts on). Science is a discipline which observe phenomena of the universe. Through science, factual and phenomenal breakthrough of the nature can be obtained through empirical activities. Science is related to facts, concepts, principles, and discovery itself. Discovery is obtained through lab experiment or from the nature. The learning process of science should be planned to implant scientific behavior to students. Besides, it also enhances students' logical thinking which becomes the background of scientific process to produce scientific products.

According to (Pudyo, 1999), SPS is divided to basic processing skills and integrated processing skills. Basice processing skills includes: observation, classification, measurement, communication, conclusion, prediction, and spatio-temporal relation. It is reflected in the research of (Aydinli, Dokme, Unlu, Ozturk, Demir, & Benli, 2011) that in basic processing skills, students are demanded to be active and have active roles. Teacher should stimulate students to use their processing skills by giving various activities implemented in class and teacher has to give students homework to motivate their processing skills. Science processing skills give life-long effect. Since, science is a special area where students can explore and experiment science processing skills (Cigrik & Ozkan, 2015)

Knowing the important meaning of science processing skills, there should be an attempt of teachr ti develop and implement the skills. The attempt can be done well in the planning or in the larning process. This planning should be real by measuring students' potentials of science processing skills. The analysis of the skills in school became the initial research to develop assessment, instrument, model, and media or other assessment which improve senior high school students' science processing skills.

METHODS

This research used descriptive qualitative method. This method was chosen because the obtained data was the description from observation of the learning process in giving the influence to students' SPS. The collection of the data in this research used non-test technique. There were many methods which can be used in non-test technique. In this research, the methods were documentation and observation. Documentation was chosen since it gave real and clear evidence as the supplementary of the observation. Meanwhile, observation was chosen since the procedure of the research was done by directly observing the classroom activities and taking notes to all activities. Both methods were chosen to support and complete a data to the other.

The procedure of the research was then continued by analyzing the result of documentation and observation. The analysis was done by using scoring instrument to students' SPS. It is aimed to know the existence of indicators to students SPS in learning process. The activities which were observed was for the material of Bryophyte and Pteridophyte. This research was done in X grade of Senior High School "Y" in Ponorogo regency starting from January to February 2017. The scoring instrument of science processing skills was to analyze and measure the instrument which was developed by (Wati & Nopianti, 2016). The instrument consisted of eight aspects: 1) formulating hypothesis, 2) planning experiment, 3) conducting experiment, 4) doing observation, 5) interpreting data, 6) predicting, 7) implementing concept, and 8) communicating. Each aspect has four indicators. Those data is portrayed in Table 1.

Table 1. Aspects and Indicators of Science Processing Skills

No.	Aspects	Indicators
1	Formulating Hypothesis	1. Formulating a rational prediction
		2. Hypothesis based on theory
		3. Hypothesis based on the objective of the research
		4. The use of proper language
2	Planning Experiment	1. Students use correct tools and devices
		2. Students are able to plan experiment
		3. Systematic experiment procedure
		4. The use of proper language
3	Conducting Expeirment	1. Concerning the use and accuracy of tools
		2. Use correct procedure of measurement
		3. Collecting data
		4. Doing the procedure correctly
4	Doing observation	1. Using all senses
		2. Accurately doing the observation
		3. Punctuality
		4. Structured Observation
5	Interpreting Data	1. Merging information from theory and result
		2. Analyzing result and connecting variables
		3. Finding a pattern of observation sequence
		4. Making conclusion from the data
6	Predicting	1. Relating data with the objective of the experiment
		2. Relating data of experiment with theory
		3. Finding the relation of data to the objective of the research
		4. Making conclusion from the experiment
7	Implementing Concept	1. The interpretation is based on the theory
		2. Answering question based on the theory
		3. Concluding based on the objective of the experiment and theory
		4. Showing causal relation
8	Communication	1. Making reports
		2. Good content of report
		3. Presenting the result of experiment well
		4. Showing the relation of the result and the objective of the experiment

Source: (Wati & Novianti, 2016).

The data were analyzed in descriptive quantitative way. It was done with the objective to know how many activities which included the SPS development. The analysis was done by counting the activities in each aspect with overall activities. It was then converted to percentage (Purwanto, 2008). The formula of data analysis can be seen as.

$$SPS = \frac{T}{U} \times 100\%$$

Note:
T: Activities of SPS
U: All activities

The category of SPS activities are based on (Riduan, 2008). The category can be seen in Table 2.

Table 2. Category of SPS

SPS Score	Categories
0% ≤ KPS ≤ 20%	Very Low
20% < KPS ≤ 40%	Low
40% < KPS ≤ 60%	Fair
60% < KPS ≤ 80%	Good
80% < KPS ≤ 100%	Very Good

Source: (Riduan, 2008)

RESULTS AND DISCUSSION

Results

The observation of students processing skills can be seen from their activities. In the larning process, the researcher obtained the data of activities involving SPS. The data can be seen in Figure 1 as follows.

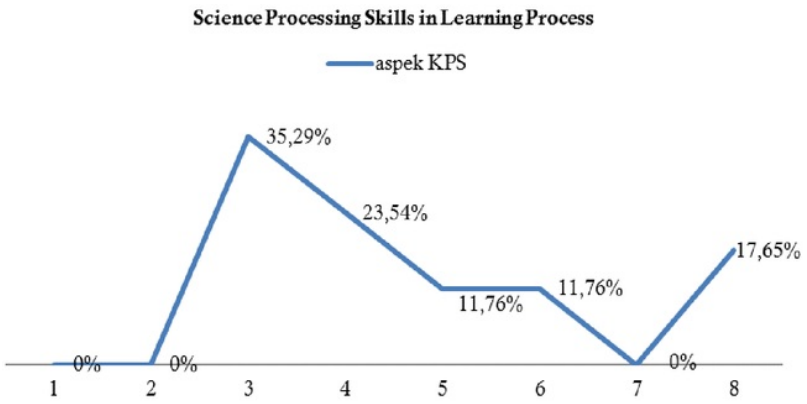

Figure 1. Science Processing Skills Aspects in Learning Process

Based on Figure 1, it obtained that there were five aspects of SPS which existed in the learning process. The aspects were available from the appearance of each indicator. 0% existed in aspects 1, 2, and 7.

Discussion

The observation of biology class to X grade students in senior high school "Y" in Ponorogo regency focusing on the material of Bryophyte and Pteridophyte showed that there was a variation of SPS. The learning process of biology in the classroom was analyzed and understood using the scoring instrument of SPS processing skills in eight aspects: 1) formulating hypothesis, 2) planning experiment, 3) conducting experiment, 4) doing observation, 5) interpreting data, 6) predicting, 7) implementing concept, and 8) communicating. The aspects also had four indicators. The analysis showed that only five of eight aspects appeared in the learning process. These aspects were aspect 3 of conducting experiment in 35.29%, aspect 4 of doing observation in 23.54%, aspect 5 of interpreting data in 11.76%, aspect 6 of predicting in 11.76%, and aspect 8 of communicating in 17.65%. Meanwhile, aspects 1 (formulating hypothesis), 2 (planning experiment), and 7 (implementing concept) were 0%.

From the analysis of data, the aspects of processing skills with highest percentage was conducting experiment. Meanwhile, there were 3 aspects which were absent in the observation: aspect 1, 2, and 7. Seeing aspect number 2 and number 3 with contradicting result, it can be caused that the students were not given a chance to plan their experiment for practicum. Students directly did a planned research from the order of the teacher. It is not wrond, considering the variation of biology material which is related to practicum and asking students to have variation of experiment. Moreover, if the teacher applies project based learning, student got a chance to plan their research. Improvements to these conditions can be done on the making of learning tools that are learning-based learning program or teaching model that has a characteristic bersintaks project. In addition, in practice-based learning, students only do practicum with work procedures that have been prepared by teachers. Based on these learning activities, the students lacked meaningful experience from the learning process.

The same condition is also seen in aspect No. 1 which is to formulate hypothesis. Aspect No. 1 has a percentage of 0, meaning that the formulation of hypotheses has not been undertaken by students during the biology learning process. Hypothesis is a temporary answer of the student's activities in formulating the problem of the problems given by the teacher, or problems related to the real condition of the environment related to the biology learning materials. To improve the activities need a model of learning that has a characteristic there is a syntax to formulate the problem and make a hypothesis. One such model is an inquiry model. According to (Trowbidge, 1981), inquiry is the process of finding and investigating problems, formulating hypotheses, designing experiments, collecting data, drawing

conclusions from problems. Inquiry processes include problems, formulating hypotheses, designing an investigative approach, testing ideas (experiments), and synthesizing knowledge. Implementation is by using inquiry as a model on learning model components and learning activities contained in the Learning Program Plan (RPP) made by the teacher so it is expected that hypothetical activities can emerge and encourage students' science process skills. This is supported by research (Mao & Chang, 1998) which states that inquiry can encourage a student-centered learning process so that the skills of the science process are improved, in addition the inquiry is designed to improve students' skills and understanding.

In the 7th aspect of the science process skills applying the concept of having 0% value, it also shows that the activity of applying the concept has not yet appeared in the biology learning process in the classroom. This condition needs to be improved by the teacher on the learning activities that give the students activities in applying the concept. One of the activities to apply the concept or principle is to calculate the number of calories produced by a number of grams of food containing food substances after students understand the concept of burning nutrients produce calories. The activity becomes part of the student practice on one of the materials. When viewed from the characteristics of biological material is very complex, then the activities apply the concept is very varied done. Improving the learning process so that the science process skills in the aspect of application of the concept emerged, the learning plan activities on the component of the method is practicum. This is consistent with research (Ardhi, 2014), which suggests that practicum can improve students' science process skills in microbiology courses because the activities at the lab encourage students to apply the concept.

Different conditions lie in aspects of 3, 4, 5, 6, 8 that have varying values, in that aspect it can be shown that the skill profile of the process of science appears in biological learning activities. This condition is in accordance with the nature and characteristics of biology as a science discipline. However, there is a need for business and plan so that the aspects that are still low among the aspects of 5 is to interpret the data of 11.76%, aspect 6 is predicting 11.76% that has not been optimal so as to improve the skills of science students in SMA Negeri " Y "Kabupaten Ponorogo. As in the study (Karsli, Yaman, & Ayas, 2010) which states that in the process of combining data and models, connect numbers and data analysis space is still very less, especially on experimental or experimental activities. In addition, aspects 3, 4, and 8 still need to be improved both in terms of planning and the process, this is because the three indicators have appeared several times in the learning activities. Not optimal aspects 3, 4, and 8 because students are still difficult in designing experiments. It is difficult to design experiments because students are initially difficult in making questions and hypotheses (Jeenthong, Ruenwongsa, & Sriwattanarothai, 2014). Hodosyova, Utla, Vanyova, Vnukova, & Lapitkova (2015) also mentioned that students in Slovakia are also difficult in designing experiments, whereas being a summative assessment in the learning process, it is necessary to develop hypotheses, variables, as well as experimental planning.

Similarly, the results of research showing 0% aspect impact on other aspects that can not be optimal in learning.

Based on existing conditions in biology learning in SMA Negeri "Y" Ponorogo regency needs improvement, especially learning conceptualized by experiment or practicum, because the learning activities with the lab encourages students to be able to find the concept and arrange its own process. In addition to the learning process that is conceptualized like experiments, other activities can be done to optimize the science process skills in the classroom such as giving questions to the students with different types, using the Q & A method, and students in the stimulus to experiment (Aktamis & Yenice, 2010). Responses from students in can be measured or assessed well if the student conducts a scientific inquiry, this process makes it easier to do the assessment in learning (Shahali & Halim, 2010). Not necessarily just a concept of learning that is able to optimize the ability of the science process, but appropriate media selection also has a significant impact on students' science process skills. Vebrianto & Osman (2011) mentioned that selecting appropriate media such as utilizing the surrounding environment as a learning medium can improve the students' science process skills, because by utilizing the environment, a more comprehensive set of activities that can be done such as observing, asking questions, proving and demonstrating , as well as checking facts.

CONCLUSION

Based on the results of the analysis can be concluded that the science classroom science skills of students of class X SMA "Y" Ponorogo regency still not optimally empowered and still in the low category. It is suggested that there should be improvement of planning and instructional design by applying variation of practice and learning model as well as the completion of phases in practicum in biology learning. It is intended that students prioritize process experience rather than product.

REFERENCES

Aktamis, H., & Yenice, N. (2010). Determination of the Science Process Skills and Critical Thinking Skill Levels. *Procedia Social and Behavioral Sciences 2* , 3282-3288.

Ardhi, M. W. (2014). Penerapan Mind Mapping dalam Upaya Peningkatan Keterampilan Proses Sains Mahasiswa pada Mata Kuliah Mikrobiologi melalui Lesson Study. *Florea Vol. 1 No.1* , 59-65.

Aydinli, E., Dokme, I., Unlu, Z. K., Ozturk, N., Demir, R., & Benli, E. (2011). Turkish Elementary School Students' Performance on Integrated Science Process Skills. *Procedia Social and Behavioral Sciences 15* , 3469-3475.

Cigrik, E., & Ozkan, M. (2015). The Investigation of the Effect of Visiting Science Center on Scientific Process Skills. *7th World Conference on Educational Sciences* (pp. 1312-1316). Athens: Elsevier Ltd.

Hodosyova, M., Utla, J., Vanyova, M., Vnukova, P., & Lapitkova, V. (2015). The Development of Science Process Skills in Physics Education. *5th World Conference on Learning, Teaching and Educational Leadership, WCLTA* (pp. 982 – 989). Elsevier Ltd.

Jeenthong, T., Ruenwongsa, P., & Sriwattanarothai, N. (2014). Promoting integrated science process skills through betta-live science laboratory. *Procedia - Social and Behavioral Sciences 116* , 3292 – 3296.

Karsli, F., Yaman, F., & Ayas, A. (2010). Prospective chemistry teachers' competency of evaluation of chemical experiments in terms of science process skills. *Procedia Social and Behavioral Sciences 2* , 778-781.

Mao, S. L., & Chang. (1998). Impacts of an Inquiry Teaching Method on Earth Science Students' Learning Outcomes and Atitudes at the Secondary School Level. *Proc. Natl. Sci. Counc. ROC (D) Vol. 3 No.3* , 93-101.

Nuryani, R. (2010). *Strategi Belajar Mengajar Biologi.* Bandung: FPMIPA UPI.

Pudyo, S. (1999). *Strategi Pembelajaran Biologi di Sekolah Menengah.* Malang: Fakultas MIPA Universitas Negeri Malang.

Purwanto, N. (2008). *Prinsip-prinsip and Teknik Evaluasi Pengajaran.* Bandung: Remaja Rosdakarya.

Riduan. (2008). *Belajar Mudah Penelitian untuk Guru, Karyawan, and Peneliti Pemula.* Bandung: Alfabeta.

Shahali, E. H., & Halim, L. (2010). Development and validation of a test of integrated science process skills. *Procedia Social and Behavioral Sciences 9* , 142–146.

Suciati. (2010). Membangun Karakter Peserta Didik melalui Pembelajaran Biologi berbasis Keterampilan Proses dalam Sajidan and Bowo Sugiharto (eds). *Seminar Naional VII Pendidikan Biologi FKIP UNS* (pp. 237-243). Surakarta: Yuma Pustaka.

Trowbidge. (1981). *Becoming a Secondary Science Teacher 4th Edition.* USA Merril Publishing Company.

Vebrianto, R., & Osman, K. (2011). The effect of multiple media instruction in improving students' science process skill and achievement. *Procedia Social and Behavioral Sciences 15* , 346–350.

Wati, & Novianti. (2016). *Pengembangan Rubrik Assesmen Keterampilan Proses Sains pada Pembelajaran IPA SMP.* Retrieved April 11, 2017, from ejournal.radenintan.ac.id: https://ejournal.radenintan.ac.id/index.php/al-biruni/index

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