Analysis of Student Science Process Skills

by Luthfiyah Nurlaela

Analysis of Student Science Process Skills
in Faculty of Engineering State University of Surabaya

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Abstract: This study aims to obtain information about Science Process Skills in vocational education at the Faculty of Engineering, State University of Surabaya. Science Process Skills (SPS), is a very important skill for students, not only in learning but also has a positive impact on student life in the future. In addition, vocational education is very important position in life because it is always in everyday life. This is in line with the demands and challenges that exist in the 21st century impacting changes in the learning patterns that exist in education in Indonesia. Education must be able to develop competent human resources that have competitiveness. So that by applying SPS it is hoped that it can foster skills and attitudes such as those possessed by scientists (scientific attitude) to achieve vocational education goals. The method used in this study is a case study. The research subjects were students of the Faculty of Engineering, State University of Surabaya, on a 39-year culinary education program with 39 students, 23 undergraduate students in electrical education and 15 undergraduate students in Civil Engineering. Data collection techniques used are measurement techniques and direct communication techniques with data collection tools in the form of observation sheets and student worksheets. The observation sheet used is a *checklist*. The results of the analysis of the value of science process skills in 2017 School of Education S1 are 24.00; S1 Electrical Education is 71.01 and S1 Civil Engineering is 67.00. So it can be concluded that the value of science process skills is still in the low or below category of the minimal completeness criteria value of 80.

1 INTRODUCTION

Education is a process that encompasses three dimensions, namely the individual, community or national community of the individual and all the material and spiritual realities that play a role in determining the nature, destiny, human form and society. Education is a process that is needed to get balance and perfection in the development of individuals and society. The emphasis of education compared to teaching lies in the formation of awareness and personality of individuals or communities in addition to the transfer of knowledge and expertise (Nurkholis, 2013).

Education always changes. One of the changes made is the curriculum. 2013 curriculum is a curriculum that is applied to every field of study. Material needs to be developed and explicit and connected with real experiences in everyday life.

Based on Law Number 20 of 2003 concerning the National Education System Chapter I General Provisions Article 1 paragraph 8 states that the level of education is the stage of education determined based on the level of development of students, goals to be achieved and capabilities developed. The Law states that the level of formal education in Indonesia consists of basic education, secondary education and higher education.

Higher Education is a level of education after secondary education that includes diploma programs, undergraduate programs, master programs, doctoral programs, and professional programs, as well as specialist programs, organized by universities based on the culture of the Indonesian nation. Higher education is one of the most important organizations in the life of the nation and state because universities produce graduates who will continue the baton of the government's struggle and advance the country's economy so as to create a prosperous, safe and peaceful country (Yati, 2017).

One of the higher education in Indonesia is State University of Surabaya. State University of Surabaya or abbreviated as UNESA has 7 Faculties. One of them is the Faculty of Engineering which consists of S1 Family Welfare Education majors, S1 Electrical

Engineering Education, S1 Mechanical Engineering Education, S1 Information Technology and S1 Civil Engineering Education otherwise known as Vocational Education.

Vocational education is an education program at the tertiary level which aims to prepare educators who can set their expertise and skills in their fields, be ready to work and be able to compete globally. In general vocational education aims to prepare students to become members of the community who have the ability of professional experts in applying, developing, and disseminating technology and / or art and striving to use it to improve people's lives and enrich national culture.

Vocational education is very important in its position in life because it is always in everyday life. The demands and challenges that exist in the 21st century have resulted in changes in the learning patterns that exist in education in Indonesia. Education must be able to develop competent human resources that have competitiveness. These challenges must be answered by all Teacher Training Institution in Indonesia to produce prospective teachers who can develop education to accord to the demands of the 21st century. Teachers today must be able to develop learning that is not oriented towards memorizing activities. Teachers must have the ability to innovate in developing learning according to the needs of the 21st century (Lepiyanto, 2014). Two things related to vocabulary that cannot be separated, namely vocational as a product (knowledge in the form of facts, concepts, principles, laws, and theories) and vocational as a process that is faithful work (E. Mulyasa, 2006).

Science process skills are a form of science as a process that is scientific work, and are very important to assist in learning to solve problems and be applied in daily life (Nur H., Muriani, 2013). This is in accordance with Zahra (2017) opinion that student skills and activities can be formed from learning with Science Process Skills (SPS), which includes observing, asking questions and formulating problems, formulating hypotheses, designing experiments, carrying out experiments, collecting and analyzing data, interesting conclusion, and present the results of his work.

The expected science process skills in learning are building principles through induction, explaining and predicting, observing and recording data, identifying and controlling variables, making graphs to find relationships, designing and carrying out scientific investigations, using technology and mathematics during investigations. In other words, the development of science process skills can foster skills

and attitudes such as those possessed by scientists (scientific attitudes) to achieve vocational education goals.

But based on the results of observations conducted at the Faculty of Engineering, State University of Surabaya in 2017 science process skills are still low. The low level of science process skills is reinforced by the results of research by Niki (2017) on 39 undergraduate students in the Department of Cooking Education in 2017, 23 undergraduate students of the 2015 Electrical Engineering Education Department and 15 undergraduate students of the 2011 Department of Civil Engineering. And control variables, declare hypotheses, operational definitions, design research and describe graphs and interpret data in difficult categories to do or still have low values. One of the factors that influence student grades is the lack of application of learning based on science process skills and human resources (UNESA Engineering Faculty students).

Increasing human resources means improving the quality of undergraduate graduates where scholars who will teach in Vocational Schools. A vocation education scholar is required to become a professional teacher. This proves that the importance of the role of human resources (students) in vocational education. This is in accordance with the Law of the Republic of Indonesia number 20 of 2003 concerning national education, that the position of teacher as an educator is a professional position.

Based on the description of the problem, the title in this study is "Analysis of science process skills of students at the Faculty of Engineering, State University of Surabaya".

2 MANUSCRIPT PREPARATION

2.1 Learning Approacnes

According to Devi (2010) states that the learning approach is the process of presenting learning content to students to achieve certain competencies with a choice or several methods. The learning process is inseparable from a learning approach so that the learning process can run well, fun, and be more meaningful. According to Rusman (2012: 380) the approach is defined as the starting point or point of view of the learning process. Meanwhile, according to Komalasari (2013: 54) the learning approach is defined as the point of view of the learning process, which refers to the view of the occurrence of a process that is still very general in that it embraces, inspires, strengthens, and underlies learning methods with

certain theoretical scope. So that it can be concluded that the approach is the viewpoint of the learning process that is still common and then strengthened using appropriate learning models and methods, namely the approach to science process skills.

2.2 Process Skills Approacnes

Approach is the treatment applied in learning which emphasizes the formation of skills to acquire knowledge and then communicates its acquisition. The skill of gaining knowledge can be by using psychic thinking skills or physical ability.

According to Henikusniati (2015) The process skills approach is a teaching approach that gives students the opportunity to understand the process of finding or drafting a concept as a science process skill. An educator, seeks to improve the quality of student knowledge, so that it can control a learning to be more meaningful, to be able to improve student learning outcomes according to the learning objectives set by the 2013 curriculum. 2013 curriculum aims to prepare Indonesian people to have life skills as individuals and citizens a country that is faithful, productive, creative, innovative, and able to contribute to the life of the community, nation, state (Ministry of Education and Culture, 2013).

The same thing was conveyed by Hosnan (2014), the science process skills approach is an approach in the teaching and learning process that emphasizes the skills of acquiring knowledge and communicating the acquisition. Science process skills also mean the treatment applied in the learning process by using thinking power and creation effectively and efficiently to achieve goals.

2.3 Objectives of Science Process Skills

According to Tawil & Liliasari in Gusdiantini (2017) science process skills are very important to be implemented early, because they see the development of science that is getting faster and more advanced so it is no longer possible for students to be taught verbally, but students must be accustomed to developing knowledge, discover new knowledge, and be able to find concepts so that it can be concluded that the purpose of science process skills is to develop student creativity in learning so students can actively develop and apply their abilities. Students learn not only to achieve results, but also learn how to learn.

This is in accordance with the opinion of Laely (2016). One of the important learning approaches to be applied is the approach to science process skills.

There are four reasons underlying the need to apply the science process skills approach. The first reason is because time is pressed for the pursuit of curriculum achievement, the educator will choose the easiest path, namely informing facts and concepts through the lecture method. As a result, students have a lot of knowledge but are not trained to find knowledge, not trained to find concepts, not trained to develop science.

The second reason, psychologists generally agree that students easily understand complex and abstract concepts if accompanied by concrete examples, reasonable examples according to the situation and conditions faced, by practicing their own efforts to discover concepts through treatment of physical reality, through handling objects that are truly real. In principle, students have internal motivation to learn because they are driven by curiosity. The task of educators is not to provide knowledge, but to prepare situations that lead students to ask questions, observe, experiment, and find facts and concepts themselves. If the role of educators is very dominant, students will learn very little, are not interested, and students lose the driving force of action or motivation.

The third reason, the discovery of science is not absolutely 100 percent absolute, its findings are relative. If educators want to instill a scientific attitude to students, students need to be trained to always ask questions, think critically, and seek the possibility of answers to one problem. Students need to be fostered to think and act creatively, the most important thing is not to give "fish" to students to eat as much as possible, but how to give "hooks" to students to be able to fish on their own.

The fourth reason, in the learning process should the development of concepts not be released from the development of attitudes and values in students. If the emphasis is on developing concepts without integrating them with the development of attitudes and values, the result is intellectualism that is "arid" without humanism. Our goal is to produce thinkers as well as human beings who are united in a person who is in harmony, harmony and balance. In other words, students have high intellectual and strong character, so they can succeed in life.

2.4 Classification of Science Process Skills

According to Rustaman (2005), science process skills are a set of skills used by scientists in conducting scientific investigations. Science process skills can be developed through direct experience

because students can better appreciate the process or activities being carried out. Process skills involve intellectual, manual and social skills. Science process skills are the ability of students to apply scientific methods in understanding, developing and discovering science. Science process skills are very important for every student as a provision to use scientific methods in developing science and are expected to gain new knowledge or develop knowledge that has been owned (Dahar, 2011).

The American Association for the Advancement of Science classifies process skills into basic and integrated process skills (Kemendikbud, 2013: 215). The process skill classification is shown in table 1.

Table 1. Basic Process Skills and Basic Skills Integrated Process.

Basic Process Skills	Integrated Process Skills
Observation	Variable Control
Measurement	Data interpretation
Conclude	Hypothesis formulation
Forecast	Defining operational variables
Classify	
Communicate	An experiment

Chiappetta & Koballa (2010), dividing *science process skills* into two, namely basic and integrated science process skills. Skills of basic science processes include observing / observing, classifying, spatial / time relationships, using numbers, taking measurements, influencing, predicting. Integrated science process skills include formulating operational definitions, formulating models, controlling variables, interpreting data, formulating hypotheses, conducting experiments. This is in accordance with the opinion of Supriyatman (2014) that process skills consist of the skill of observing, raising questions, designing and making, predicting, hypothesizing, communicating effectively, designing and planning investigations, measurements and calculations, finding patterns and relationships, manipulating materials and equipment effectively.

3   METHOD

Method used in this study is a case study. Case *studies* are a method for collecting and analyzing data regarding a case. The research subjects were 39 students of the Faculty of Engineering, State University of Surabaya, in S1 Catering Education, 23 in Electrical Education S1 And 15 in Civil Engineering S1. Data collection techniques used were measurement techniques and direct communication techniques with data collection tools such as observation sheets and sheets. Student work. The observation sheet used is a *checklist*. Student worksheets are sheets filled in by students based on the assessment aspects desired by researchers who are then given a score and changed in percentage form. The Science Process Skill Sheet was obtained from the 2017 Niki instrument test. The data processing in this study was done by giving scores to each sub-indicator made by students. The indicators used are indicators identifying and controlling variables, indicators expressing hypotheses, indicators in defining operations, indicators in designing research and indicators in describing graphs and interpreting data.

4   RESULT AND DISCUSSION

The results of this study consisted of the recapitulation of the value of Science Process Skills obtained from the instrument test at the Surabaya Faculty of Engineering, namely 2017 Department of Culinary Education 2017, S1 2015 Electrical Engineering Education & S1 Civil Engineering 2011.

Table 2. Recapitulation of Value of Science Process Skills S1 Home Economics Education 2017

No	SPS Integrated	Level of Indicator Difficulty Level	Level difficulty SPS Integrated
1	Identifying and controlling variables	28	
2	Stating hypotheses	26	
3	Operational definitions	21	24
4	Design research	24	
5	Describe and interpret data	20	

Skills Process of Science in Education Catering 2017 Faculty of Engineering, State University of Surabaya based on Table 2 still below the minimum completeness criteria. Minimum completeness criteria in 2017 Home Economics Education 2017 is worth 80 while the results of the SPS test are obtained 24. This value is obtained from the 2017 Niki instrument test. The instrument is divided into five SPS indicators. These indicators include identifying and controlling variables, declaring hypotheses, operational definitions, designing research, and describing and interpreting them.

Of the five indicators there is not one single indicator that is complete because it is still under the minimum completeness criteria. There are indicators that get the lowest value, namely describing and interpreting data that get a value of 20, then the second sequence of operational definitions of variables that get a value of 21, third order designing research that gets a value of 24, fourth order declaring a hypothesis that gets a value 26 and the highest is identifying and controlling variables that get a value of 28.

Based on the lowest order, the 5th indicator gets a value of 20 because Educators are not accustomed to assigning assignments in terms of describing and interpreting data so that students get low scores in this regard. The lowest sequence to 4 gets a value of 21 because Educators never give a task to define a problem or commonly called "operational definition" so that students do not understand the questions given well and cannot work. The third lowest order gets a value of 24 because Educators have given assignments to design a study but in this case it turns out that students fail / are unable to understand how the stages of designing a study so students waver given questions about designing research. The fourth sequence gets a value of 26 because Educators never teach "How to form hypotheses/declare hypotheses" so that many students cannot design hypotheses (only a few students can design hypotheses). The highest order with a value of 28 because Educators do not teach how to identify and control a variable so that students cannot identify and formulate a variable properly. Because there are many indicators that have not been taught by Educators, one of them is because students are still in semester 1 or classified as new so that students have not received courses on the indicators contained in the SPS Test.

Table 3. Recapitulation of the Value of Science Process Skills
S1 Electrical Engineering Education 2015

No	SPS Integrated	Level of Indicator Difficulty Level	Level difficulty SPS Integrated
1	Identifying and controlling variable	92.55	
2	Declaring hypothesis	39,13	
3	Operational Definition	61,59	71.01
4	Designing research	83,15	
5	Describing and interpreting data	71,01	

Based on Table 3 with the lowest order is the 5th indicator gets a value of 39.13 because educators are not accustomed to giving assignments to formulate a hypothesis so that students get low scores in that case. The fourth lowest rank gets 61.59 because Educators never give a task to define a problem or commonly called "operational definition" so that students do not understand the questions well and cannot work on / formulate operational definitions. The third lowest order gets a value of 71.01 and has the same value as the difficulty level of SPS. In assigning assignments, Educators give examples of how to describe and interpret data so that students are rather familiar in formulating data. The fourth sequence gets a value of 83.15 which is designing a study because educators familiarize students to design a study so that when given a question to design a study, students are accustomed to getting the value above the level of integrated difficulty. The highest sequence with a value of 92.55 is to identify and control variables because educators often teach / provide lessons to identify / control a variable so that students easily answer questions correctly and get good grades.

Table 4. Recapitulation of 2011 Civil Engineering S1 Science Process Skills

No	SPS Integrated	Level of Indicator Difficulty Level	Level difficulty SPS Integrated
1	Identifying and controlling variables	83	
2	Declaring hypotheses	44	
3	Operational definitions	59	67,00
4	Designing research	83	
5	Describing and interpreting data	67	

Based on Table 4 with the lowest order, the second indicator gets 44 due to Educators ever give assignments related to a hypothesis, but when given questions about hypotheses few students can answer. This lack of student understanding needs to be analyzed while the Student has taken the Thesis. The lowest sequence to 4 gets a value of 59 because Educators have given the task of defining a problem or commonly called "operational definition" but students do not understand the questions given well and cannot do well because students do not understand the questions well. The third lowest order gets 67 because Educators have given assignments to describe and interpret data but in this case it turns out that students are still on average who are able to understand how to interpret data. Students tend to only be able to describe a table but cannot define it properly. A high order consists of 2 indicators, namely Identifying and controlling.

Variables and Designing a study to get a good score of 83 because Educators often give subjects and Students have taken Thesis so it is easy to work on questions related to variables and design a study.

5 CONCLUSIONS

5.1 Conclusion

From the three SPS data in 2017 Department of Culinary Education, S1 2015 Electrical Engineering Education & 2011 Civil Engineering S1 Faculty of Engineering, State University of Surabaya, which has the highest SPS score is in S1 Electrical Engineering Education 2015.

The results of SPS FT percentage UNESA as a whole can be seen in Figure 1 below.
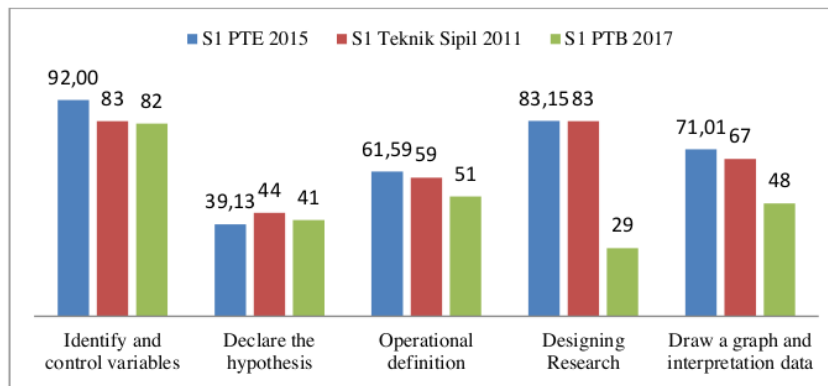

Figure 1. Picture of the percentage of SPS FT UNESA

2015 Electrical Engineering Education has the highest SPS value due to applying research/IT-based learning. S1 Electrical Engineering Education 2015 is one of the majors that strives to adjust to improving the quality of education and formation. And the development of the personality of the Student so that it has a higher SPS value than the other Departments.

From the three data, the results showed that indicators identified and controlled variables and designed the study to be complete in S1 Electrical Engineering Education 2015 and S1 Civil Engineering 2011. There were also indicators that were close to completeness but only in S1 2015 Electrical Engineering Education on indicators Describing and interpreting data. In other indicators it is still far from complete value. From these findings it can be concluded that students in the sample schools have not yet completed the mastery of PPP, especially for indicators stating hypotheses and operational definitions.

The department in the Faculty of Engineering, State University of Surabaya has not yet fulfilled the value of completing science process skills. Based on these findings, science process skills must be improved. This is in accordance with the research of Sukarno and Hamidah (2013) which states that the low level of science process skills of students is caused by many factors, including 1) the low ability of teacher SPS; 2) lack of teaching materials that develop and increase student PPPs; 3) lack of guidance in developing assessment tools based on science process skills for both teachers and students.

Science process skills in its implementation require synergy between Educators and Students. Learning Vocational education can be seen as a process, as a product, and as a developer of scientific attitudes. The object of the process of vocational education is scientific work (procedures) and product objects Vocational education is factual, conceptual, procedural and meta cognitive knowledge of vocational education. Learning objectives Vocational education is to understand the development of technology which greatly affects daily life. Therefore, students should be given the opportunity to observe, study the development of technology. By observing and interacting directly with the object to be studied, Students will remember longer the concepts learned. Learning Vocational education is very much influenced by the student's knowledge. Teaching is not just transferring knowledge from educators to students. The role of the Educator is more than a mediator and facilitator who helps students form their mindset. Educators are not the source of all knowledge. Students will understand and understand well and have competence if he is actively learning independently (processing resources, practicing, formulating in his own mind).

The development of vocational education is accelerating so that educators may not be able to teach all content (facts and concepts) to students. Students must be active in the development of technology and

in their limitations, it is impossible to know all the facts that have been discovered by experts. Because of the urgency of time to pursue the achievement of the curriculum, and the assessment of learning outcomes which are also only oriented towards cognitive achievement, educators will choose the easiest path, namely informing facts and concepts through the lecture method. As a result, students only have knowledge but are not trained to find concepts scientifically. Educators should develop learning models that are oriented to the effective and psycho motor domains, so that students can develop skills in processing all facts, concepts, and principles in students.

Learning Vocational education must be carried out by students through a number of scientific steps used by experts in discovering developing technologies and discovering theories. These scientific steps were later adopted in learning vocational education. By doing practice (experiment) Students no longer just read books/listen to lectures from educators only.

Learning that can develop student skills and stimulate students to be active and creative is one of them is learning with a science process skills approach. The learning process involves more students to act more actively, and manage their findings obtained from aspects of skills. Student skills development can be obtained through a science process skills approach in the learning process. This is due to several things, namely: first, the development of vocational education is progressing faster so that it is no longer possible for educators to teach all facts and concepts to students. Second, students easily understand complex and abstract concepts if accompanied by concrete examples experienced through their own practice so they find concepts through practical activities. Third, in the teaching and learning process concept development is not released from the development of skills, attitudes and values of students.

Vocational education does not only consist of a collection of knowledge or various kinds of facts that must be memorized, vocational education also consists of an active process of using thought in equipping existing technological developments in the World. Education experts regulate the product Education process. And the facts in the field, although vocational education pays attention to the student's self-development process and instills concepts and skills, learning vocational education must be useful for personal life as well as community. Therefore, learning Education can encourage the development of these things related to education, skills training, and

skills needed by experts to achieve Educational goals. Individuals who cannot use SPS will experience difficulties in their daily lives (Aydogdu, Erkol and Erten, 2014). In other words, the process of developing skills can foster skills and attitudes as requested by scientists (scientific attitude) and understand the difficulties of the science process to be developed and supported by each student to get the product of vocational education goals.

5.2 Suggestion

Based on conclusions, the results of the research are several suggestions, namely:
1. Based on the results of the educator's research that the PPP must do well, be approved, the PPP can be developed properly;
2. Applying PPP to students as prospective educators by developing learning tools that can train the learning process in Higher Education and;
3. Improve the quality of students by being given training in process skills.

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GENERAL COMMENTS

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