The Distinction of Students’ Science Process Skill and Learning Activities between Guided Inquiry and Conventional Learning with Experiment

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Abstract. The chemical knowledge of students was low because learning activities tend to be teacher oriented. For this reason, we need to develop knowledge acquisition process skill. Therefore we suggest scientific attitude which included in the “Science Process Skill”. The purpose of this research was to determine the type of learning model which was able maximize the students' scientific processes skills. The results of the application can be observed in student learning activities during observation. A quasi-experimental control group with pre and post-test design was performed in this study. The sample were students in XII MIA-1 in SMAN 5 Binjai which applied Guided Inquiry learning model meanwhile XII MIA-2 applied conventional learning. The results showed that the Science Process Skills in both experiment classes obtained an average score of 93.78 and 75.32 respectively so that they were categorized as "Very Good" and "Good" on 6 (six) aspects: observing, grouping, applying concepts, interpreting, conducting experiments, formulating hypotheses. While learning activities obtained an average score of 90.27 and 79.29 respectively, so that they were categorized as "Very Good" and "Good" on the five indicators: Readiness to learn, skills for using tools, actively providing opinion, working in group and making conclusion.

1. Introduction

Survey result which conducted by the Program for International Students Assessment (PISA) in 2018 reported the science ability of Indonesia students was ranked 70th of 79 countries with average score points 396, this number is lower than Malaysian students who have average score 438 and Singapore with average score 551. The first rank was achieved by students from Shanghai, China with average score 590 [1]. This data showed us that Indonesia’s quality of education especially for science was still low and we need to something to fix it.

If we try to figure out what was contributing to our educational systems which lead to failure of students achieving their goal, there are two factors respectively internal and external factors. The internal factors came from the student itself, simply told as their interest or motivation to learn. Meanwhile, the external factors came outside the student, for example the learning method, parents’ attention and many else [2]. Since this case have large area, we want to limit the problem to formulate specific solution, therefore an observation was done.
In chemistry education, based on observation which was conducted in SMAN 5 High School there were many students thinks that chemistry was a difficult subject. This was mainly because learning activities in the class tended to apply teacher-oriented method that make students feel chemistry was not only difficult but also monotonous. So important improving the quality of learning can be implemented from chemistry teacher to students so student be able to mastery of the process of science. Mastery of the process in learning science requires a scientific attitude that is called Science Process Skills.

Science Process Skill (SPS) is learnable if teacher taught by using some proven teaching methods [3]. Therefore, the availability of teaching and learning media, also well-prepared teachers as facilitators in learning is the key to develop SPS. However, based on the survey which conducted by Artayasa et al. [4], mostly teacher do not familiar with strategies to apply the learning methods in the classroom. Hence, we suggest a learning model which able to enhance students’ conceptual understanding and to empower their SPS which named as Guided Inquiry learning model.

In addition, there is also other model which able to be applied to Science Process Skill, it is conventional learning model which was integrated with practicum activity. Science Process Skill is the complex ability which is used by scientists in conducting scientific investigation into the series of the learning process [5]. According Limatahu, Sutoyo and Prahani [6], Science Process Skill is the ability of students to apply scientific methods to understand, develop and discover science. SPS is quite important for every student in preparing to use scientific methods in developing science and are expected to acquire new knowledge or develop the knowledge that has been owned. However, we must remember that the learning approach is not only the case of transferring knowledge, but also emphasizing on the process of scientific inquiry. In this learning approach, the teacher acts as a facilitator who guides and manages students’ learning activities so that students are able to construct necessary facts, concepts, and new values independently [7].

Interest is a powerful dictator and motivator in the learning process and learning activity. Students are more willingly give their attention to engage in more learning activities if their interest and emotions are positively provoked [13]. So, if the learning materials are delivered such that it able to attract student’s attention more by themself spontaneously than learning will take place with very good impact [2].

The learning activity is defined as the ability of students to conduct research and all of students’ interactions to solve problem based on practicum, as measured by five indicators, namely: (1) readiness to learn, (2) skills for using tools, (3) actively providing opinion, (4) working in group and (5) making conclusion [8]. Learning activity have a strong relationship with science process skills because these indicators are supporting each other. In this study, Guided Inquiry and conventional learning with experiment laboratory will be compared to find the best result in students’ score in both Science Process Skills and learning activities.

Neka [17], they have analysed how to make students becoming mastery the concept, attitude and scientific process skill by implementing Guided Inquiry learning model. They are planning instruction, recapitulating the N-Gain and Implementing guidelines for interview. Not only take measurements but also conclude the results which obtained so that it may become new information. After that, predicts possible outcomes in the observation. So that we may say that there is a mastery of concept, scientific attitude and science process skill of students after Inquiry approach applied social interactions with the media environment of the school.

Arantika [11], in inquiry module, there is a stage of defining problem which given to the students. As action, the students set predictions and formulate hypotheses in the step of formulation of the problem which followed by executing experiments and data collections to test the hypothesis. When analyse is conducted by researcher with observing students’ way to collect the data and experiment, and the inquiry analysis was done by making conclusion on what findings were obtained and whether the hypotheses were correct. As result, they confirmed that the science inquiry approach able to provide students'science process skill through inquiry process.

Limatahu [6], explained that students who have lower SPS were affected by their initial experience before starting the basic physics laboratory is quite small, consequently their knowledge about the
concept in the practicum topic is lower, on top of that the availability of practicum tools and the current practicum guidance did not train their SPS well. Arlianty [2] also stated that the crucial thing is the quality of students’ experiences. Similar with previous research, they found that the understanding of the nature of scientific inquiry is as negative as their conceptual understanding. This statement is strengthening the argument that students should have practicum experience from teachers as early as possible because this ability needed especially to be a student’s stock when they become students at such university. Therefore, a practicum guide is needed as one of the learning resource in practicum activities to develop students’ science process skills.

Rismawati, et al [12], explained students’ SPS which taught by using problem-based learning model is better than students which taught by conventional learning in the physics learning. The interesting fact from Casselman [13], who has implemented the student-centered approach in the early stage of education, and it is really helpful for attaining students’ life-long learning skill and effective the attributes.

Magunayasa, Dantes, Marhaeni and Suastra [8], it can be argued that interest in learning activity is a key factor in the field of science education. After these activities, an experiment is furthermore designed and carried out, the evidence is collected, and conclusion stated. Akram et al [14], the students were pleased with the Performance of their Chemistry Teacher as the mean values showed strong agreement and based on Personal Choice, students voted that enjoy to do chemistry experiment and have a lot of question about chemistry in their mind.

2. Methods

A quasi-experimental control group of pre-test-post-test design was performed in this study. Experimental research design was employed to evaluate the distinction of Science Process Skill (SPS) and learning activities in Experiment Class-I and II. To determine which teaching method that has significant effect toward the performance, pre-test and post-test was conducted in this study.

Samples covered 66 students from SMAN 5 Binjai which is located at Jl. Jambi No.2, Binjai Estate, Kota Binjai, Sumatera Utara, Indonesia 20723 in the odd semester of the 2018/2019 academic year. The population in this study were all students of class XII MIA at SMAN 5 Binjai consisted of 6 classes and the sample was determined by using the technique of purposive sampling which produced two classes, namely XII MIA-1 (Experiment I) which applied Guided Inquiry learning model and XII MIA-2 (Experiment II) which applied conventional learning learning model.

Two instruments were used in this research, they were Science Process Skill Test (SPST) and Learning Activity Test (LAT). The SPST was developed by researchers in order to measure the students’ Science Process Skill in six different aspects. It consisted of 6 essay questions covered observing, grouping, applying the concept, interpreting, designing experiment and formulating a hypothesis, adapted by Tawil and Liliana [15]. The minimum and maximum scores that could be obtained by each student were 0 points, 10 and 20 points, score was created with depending on quantity of each number. While LAT was developed by researcher to measure the practicum activity related to ability of students to operate laboratory props with different learning model methods. The minimum and maximum score that could be obtain by students when researcher observe them were 1 to 5 point. It consists of readiness to learn, Ability to use tools and materials in laboratory, actively providing ideas and opinion, working in group and making conclusion. All instruments were developed by the researchers and validated by senior science lecturer and instructional experts from State University of Medan, Medan City, Indonesia.

The procedure of the research was consisted of four stages, namely: the pre-research, preparation, implementation and final stages. The data collection was done by using pre- and post-test for Science Process Skill and observation sheet for learning activity. In the Science Process Skill, the test instrument is applied through valid essay tests as many as 6 items. From the pre-test scores, students have been tested for prerequisite analysis, namely normality and homogeneity and closed by two tails t-test.

Furthermore, an analysis of differences in learning activities’ data was analysed when students were taught by using the Guided Inquiry and conventional learning when doing their practicum. The steps for implementing the Guided inquiry and conventional learning as shown in Table 1 and Table 2
respectively. Data analysis was started by assessing each students’ answer at each instrument. In addition, for validity was using r-product moment and reliability was using Alpha-Cronbach then compared the result with criteria score of validity and reliability.

| Table 1. The Syntax of Guided Inquiry Learning Model |
|-----------------------------------------------------|
| **Stages** | **Activities** |
| Present question | Students listen to the identification of the problem presented |
| Make a hypothesis | Students express their opinions and make relevant hypotheses |
| Design an experiment | Students find and sort the steps that have been made |
| Carry out an experiment | Students listen for guidance to get relevant information |
| Analyse relevant data | Students submit the results of data processing obtained |
| Making a conclusion | Students submit conclusions obtained from experiments |
| Provide opportunities for advanced training and implementation | Students carry out advanced training provided by the teacher and prepare the application of special training |

| Table 2. The Syntax of conventional learning Learning Model |
|-----------------------------------------------------------|
| **Stages** | **Activities** |
| Delivering goals and preparing students | Students listen to the information conveyed by the teacher carefully |
| Demonstrate knowledge and skills | Students observe the demonstration of the skills delivered by the teacher |
| Guiding training | Students follow the initial guidance from teacher |
| Check understanding and provide | Students carry out the tasks given by the teacher carefully and correctly |
| Provide opportunities for advanced training and implementation | Students carry out advanced training provided by the teacher and prepare the application of special training |

3. **Result and Discussions**

3.1. **Results**

The renewal of this research is differences score of Science Process Skill (SPS) and learning activity shown by two difference learning models. In this research, students’ Science Process Skill was measured by using essay-tests instrument. The criteria for measuring the achievement of Science Process Skill are measured based on 6 (six) aspects of SPS namely observing, grouping, applying concepts, interpreting, conducting experiments, formulating hypotheses [16], which were divided into several points assessment on 6 items essay-test questions which have been made by the researcher. Data analysis of Differences in student’s Science Process Skill is summarized in Table 4.

The score of pre and post-test of Science Process Skill (SPS) in Experiment class I and II is given in Table 3. While the average score of student’s initial and final abilities in both classes for each item in the indicator process science skill is shown in Table 5. Then an analysis of the differences in the percentage of students’ Science Process Skill in each observed aspect during the learning process is seen in Table 4. Based on the percentage of difference in SPS, we found the average score of students’ in
Experiment Class I were much higher than Experiment Class II. A graph analysis of the differences in the percentage of students’ SPS in each aspect of Science Process Skill is illustrated in (Fig 2).

| Experiment Class | Average Value | Deviation Standard | Variance |
|------------------|---------------|---------------------|----------|
|                  | Pre-test      | Post-test           | Pre-test | Post-test | Pre-test | Post-test |
| I                | 26.5          | 89.6                | 7.7      | 5.6      | 56.8     | 30.1      |
| II               | 26.3          | 78.4                | 6.9      | 4.7      | 46.7     | 21.8      |

Table 4. Differences in Student’s Science Process Skill

| Aspect of Scientific Process Skill | Experiment I | Experiment II |
|-----------------------------------|--------------|---------------|
| Observing                         | 84.42%       | 75.16%        |
| Grouping                          | 91.89%       | 82.83%        |
| Applying the Concept              | 95.94%       | 83.82%        |
| Interpreting                      | 95.94%       | 83.33%        |
| Designing Experiment              | 93.67%       | 79.27%        |
| Formulating a Hypothesis          | 89.87%       | 74.73%        |

Table 5. Recapitulation of Implementation of Scientific Process Skill in Guided Inquiry Learning Model

| Syntax of Guided Inquiry | Evaluation of Implementation |
|--------------------------|-------------------------------|
|                          | Observer 1 | Observer 2 | Observer 3 |
|                          | K1  | K2  | K3  | K4  | K5  | K6  |
| Step 1                   | 85  | 70  | 80  | 84.75 | 84.5 | 70  |
| Step 2                   | 89.6 | 70  | 94.6 | 82.6 | 81  | 86  |
| Step 3                   | 90  | 94  | 84  | 90  | 92  | 86  |
| Step 4                   | 95  | 94.67 | 85  | 94.17 | 90.83 | 84.17 |
| Step 5                   | 93  | 94.71 | 91.57 | 92.57 | 95.29 | 94.71 |
| Step 6                   | 93.33 | 94.33 | 91.67 | 95  | 93.33 | 95  |

Table 6. Recapitulation of Scientific Process Skill’s Implementation in Conventional Learning Model

| Syntax of conventional learning | Evaluation of Implementation |
|---------------------------------|-------------------------------|
|                                 | Observer 1 | Observer 2 | Observer 3 |
|                                 | K1  | K2  | K3  | K4  | K5  | K6  |
| Step 1                          | 71.6 | 70  | 70  | 70.3 | 70.8 | 70  |
| Step 2                          | 76.3 | 75  | 73.8 | 73.3 | 75.8 | 70  |
| Step 3                          | 70  | 70  | 70  | 70  | 70.8 | 75.8 |
| Step 4                          | 70.8 | 70  | 76.6 | 70  | 70  | 75  |
| Step 5                          | 76.7 | 73  | 72.8 | 74.4 | 74.4 | 80.6 |

3.2. Discussions

3.2.1. Implementation of Science Process Skill in Learning Model. To obtain an overview of practical lectures’ effectiveness with Guided Inquiry model, an observation sheet was made involving three observers. In this study, there are 3 observers. The results of the assessment in each Guided Inquiry
syntax are given in Table 6. Based on Table 5, the percentage of implementation of each aspect of Science Process Skill can be made using a Guided Inquiry model as shown in Fig 4.

**Figure 1.** Average Score of Students’ SPS in Both Experiment Classes

![Figure 1](image1)

**Figure 2.** Differences of Scientific Process Skill in Each Aspect

![Figure 2](image2)

Furthermore, observations were made with implementation of Science Process Skill (SPS) in the conventional learning model is demonstrated in Table 6. From Fig 4, we see that implementation of SPS of students with a Guided Inquiry learning model has “Good” categorized in each syntax. Based on Table 4, a percentage of the difference in each aspect of Science Process Skill can be made using conventional learning model is shown in Fig 5.

**Figure 3.** Difference in the value of Learning Activity

![Figure 3](image3)

3.2.2. **Student’s Activities Learning.** The data from students’ learning activities which conduct in both experiment classes was shown in the students’ scores in five indicators from each-meeting was obtained variety results, as Table 7 below. The score of each indicator at Experiment Class I is shown in Table 9. Scores in Experiment Class I with different indicators are "Very Good" (VG). Furthermore, the result
of the student learning activities assessment in the Experiment Class II (learning with conventional learning model) as shown in Table 9.

### Table 7. Assessment of students’ learning activities at each meeting (Experiment Class I)

| Indicator | Observed Score | Score at meeting |
|-----------|----------------|------------------|
|           | I | II | III |
| Readiness to Learn | Preparing the tools and materials | 91,67 | 92,42 | 91,67 |
| Ability to use tools and materials in laboratory | Skill fully using props | 84,09 | 85,61 | 84,85 |
| | Mastery of practicum procedures | 93,18 | 87,88 | 88,64 |
| | Understanding for measuring materials | 88,64 | 89,39 | 89,39 |
| Team work | Solidarity in one team | 92,42 | 89,39 | 88,64 |
| Working in group | Punctual completing the practicum | 84,09 | 87,88 | 85,61 |
| | Cleanliness of practicum area and instrument tools of labora | 87,88 | 90,15 | 86,36 |

### Table 8. Recapitulation the assessment of each indicator (Experiment Class I)

| Indicator | Observed score | Average At Indicator | Criteria |
|-----------|----------------|---------------------|----------|
| Readiness to Learn | Preparing the tools and materials | 91,92 | 91,92 | Very Good |
| Ability to use tools and materials in laboratory | Skill fully using props | 84,85 | | |
| | Mastery of practicum procedures | 89,90 | 87,80 | Very Good |
| | Understanding for measuring materials | 88,64 | | |
| Actively providing ideas and opinion | Students’ participation for giving their ideas and opinion | 90,15 | 90,15 | Very Good |
| Working in group | Punctual completing the practicum | 85,86 | | |
| | Cleanliness of practicum area and instrument tools of laboratory | 88,13 | 87,00 | Very Good |
| Making conclusion | Preparing the tools and materials | 88,89 | 88,89 | Very Good |
Table 9. Assessment of student learning activities at each meeting (Experiment Class II)

| Indicator                                  | Observed Score                         | Score at meeting |
|--------------------------------------------|----------------------------------------|------------------|
|                                            |                                        | 1    | 2   | 3   |
| Readiness to Learn                         | Preparing the tools and materials      | 75   | 74,2| 75,8|
|                                            | Skillfully using props                 | 72,7 | 70,5| 70,5|
| Ability to use tools and materials in lab | Mastery of practicum procedures        | 74,2 | 73,5| 71,2|
|                                            | Understanding for measuring materials  | 78   | 73,7| 76,5|
| Actively providing ideas and opinion       | Students’ participation for giving     | 78   | 78  | 83,3|
|                                            | their ideas and opinion                 |      |     |     |
| Working in group                           | Punctual completing the practicum      | 81,1 | 77,2| 81,8|
|                                            | Cleanliness of practicum area and      | 85,6 | 82,6| 81,8|
|                                            | instrument tools of laboratory         |      |     |     |
| Making conclusion                          | Preparing the tools and materials      | 86,3 | 81,8| 82,6|

Table 10. Recapitulation the assessment of each indicator (Experiment Class II)

| Indicator                                  | Observed Aspect                         | Average | At Indicator | Criteria |
|--------------------------------------------|----------------------------------------|---------|--------------|----------|
| Readiness to Learn                         | Preparation of tools and materials     | 75,00   | 75,00        | Good     |
|                                            | Skillfully using props                 | 71,21   |              |          |
|                                            | Mastery of practicum procedures        | 72,98   | 73,43        | Good     |
|                                            | Understanding for measuring materials  | 76,10   |              |          |
| Actively providing ideas and opinion       | Students participation for giving their ideas and opinion | 79,80   | 79,80        | Good     |
| Work in group                              | The timeliness of the team completing  | 80,05   | 81,69        | Good     |
|                                            | the practicum                          |         |              |          |
|                                            | Cleanliness of practicum area and      | 83,34   |              |          |
|                                            | instrument tools of laboratory         |         |              |          |
| Make conclusion                            | Make the lab report                    | 83,59   | 83,59        | Good     |

3.2.3. Descriptive Result of Learning Activity in Experiment Class I. It is clearly that tabulation of the assessment of students’ learning activities carried out in experiment class I (Table.7) as many as 3 meetings, the results were obtained that all students’ learning activities had fulfilled all five indicators with the category "Very Good" (SB).

The average value of students’ learning activities is obtained on the indicator of “Readiness to Learn” is 91.92 so that it is categorized as "Very Good" (SB); the indicator of skills using tools and materials is 87.80 categorized as "Very Good" (SB); the third indicator “Actively Providing Ideas and Opinions” is 90.15 categorized as "Very Good" (SB); the fourth indicator “Working in Group” 87.00 categorized as "Very Good" (VG) and the fifth “Making Conclusion” indicator concluded is 88.89 so that it is categorized as "Very Good" (VG).
The ability of students for understanding the topic by implementing the Guided inquiry as the appropriate model have given impact for the Learning Activity score in three meeting observations. For instance, when students were asked to give their opinions by delivering their hypothesis related to, it has increased student participation. As the result, to prove their own opinion students tend to active for conducting practicum based on teacher instruction. The results of the assessment in students’ learning activities indicate that the use of Guided Inquiry has been able to increase student learning activities in the learning process, the activeness that arises from students in class XII MIA-1, namely: students appear to be more skilled in preparing practical tools and materials, students are able to work well together during practicum activities take place and have good teamwork when discussing formulating hypotheses to be able to solve problems. Students are also more active precisely giving their own opinion and ideas during the practicum. This is evidenced by the ability of students to write tools, materials and work steps that are complete and able to make appropriate conclusions in the Student Inquiry Worksheet based on Guided Inquiry.

3.2.4. Descriptive Result of Learning Activity in Experiment Class II. Based on average score of each meeting, we did recapitulation of assessment in each indicator at Experimental-I as in the Table 10. The results of the students’ assessment from Experiment Class II (consisted of 3 meetings) indicated that all student learning activities only achieve five indicators with "Good" (G) category meanwhile average score of learning activities from the readiness to learn indicator is 75.00 such that it is categorized as "Good" (G). Figure 5 below shows the assessment of the distinction in achievement of five indicators of students’ learning activities in the Experiment Class I and II.

The average score of student learning activities obtained in the experiment class-II was lower than experiment class-I because most students could not master the practicum procedure because students were only required to observe the practice through demonstration activity carried out by the teacher in front of the class. This results in students only writing what is displayed by the teacher without proving themselves how this can happen as well as through practicum.

Figure 4. Implementation of Science Process Skill in Guided Inquiry
4. Conclusion
The implementation of Guided Inquiry and conventional learning model has shown significant different impact both in Scientific Process Skill and Learning Activity. The application of Guided Inquiry in learning has given very good result reviewed from the result of Science Process Skill in each indicator in the percentage of post-test achievement in each meeting based-laboratory application framework. This good result has happened because Guided Inquiry syntax is really matched to enhance the scientific process skill of students, particularly in “Formulating a Hypothesis” which gains score is 95 than the control class by conventional learning model that not having this syntax. This implies the implementation of Guided Inquiry-Based modules is more effective to provide an impact to develop students’ science process skill.

Furthermore, by applying this learning model in the practicum, six point of Learning Activities with 6 (six) measured aspects: Readiness to learn, skills for using tools, actively providing opinion, working in group and making conclusion are categorized as "Very Good” result, particularly actively providing ideas and opinion with score is 90.15. It shown that the treatment learning models really influence the result of student’s science process skill and learning activity. Guided Inquiry learning model makes student feel the learning is meaningful, also able to build the information through SPS and implement it in their learning activity.

Research-based learning is better than memorizing techniques or following only the teacher instruction. This is based on laboratory research with Guided Inquiry model which let the students improve their SPS. Additionally, students in Experiment Class I can make their own hypothesis and can solve problem independently. These make students can find out the answers of their own questions and proofs their own hypothesis. Finally, suggestion from researcher in the future, in order to enhance students’ SPS, we recommend conducting similar research which combine the relation of SPS and learning activity in senior high school students, with different learning model. Also making new guide procedure in practicum and enhancing awareness of students for reading the related chemistry materials before practicum.

References
[1] OECD. (2018). PISA 2018 Draft Science Ability. OECD. Paris.
[2] Arlianty, W.N. 2017. An Analysis of Interest in Students Learning of Physical Chemistry Experiment Using Scientific Approach. Intern J of Scie and App Scie. Vol.1(2). doi: 10.20961/ijsascsv1i2.5130.
[3] Firdaus, F., Suratno., and Fikri, K. 2019. The analysis of discussion pattern of lesson study-based learning process skill in vocational school. *Journal of Physics*. doi:10.1088/1742-6596/1211/1/012096.

[4] Artayasa, I. P., Susilo, H., Lestari, U., & Indriwati, E. 2017. The effectiveness of the three levels of inquiry in improving teacher training students’ Science Process Skills. *Journal of Baltic Science Education*, Vol. 16(6), 908-918.

[5] Derilo, R. C. 2019. Basic and Integrated Science Process Skills Acquisition and Science Achievement of Seventh-Grade Learners. *European Journal of Education Studies*. Vol. (6) 1.

[6] Limatahu, I., Sutoyo, W.S and Prahani, B.K. 2018. Development of CCDSR Teaching Model to Improve Science Process Skills of Pre-Service Physics Teachers, *J of Baltic*, Vol. 17(5): 812-827.

[7] Siahaan, P. Suryani, A. Suhendi, E and Syamsyudin. 2017. Improving Students’ Science Process Skills through Simple Computer Simulations on Linear Motion Conceptions. *Journal of Physic*. doi:10.1088/1742-6596/812/1/012017.

[8] Magunayasa, I.G, Dantes, N., Marhaeni, A.A.I.N dan Suasta, I.W. 2019. The Effect of Guided Inquiry Learning and Cognitive Style on Science Learning Achievement. *International Journal of Instruction*. Vol.12(1).

[9] Saputro, A., Irwanto, Atun, A and Wilujeng, I. 2019. The Impact of Problem Solving Instruction on Academic Achievement and Science Process Skills among Prospective Elementary Teachers, *Journal of Elementary Education*, doi:10.17051/ ilkonline.2019.561896.

[10] Kuswanto, H and Hardianti, T. 2017. Difference among Levels of Inquiry: Process Skills Improvement at Senior High School in Indonesia. *J of Instruction*. Vol.10 (2).

[11] Arantika, J., Saputro, S., and Mulyani,S. 2018. Effectiveness of Guided Inquiry-Based Module to Improve Science Process Skills, *International Conference on Mathematics and Science Education*. doi:10.1088 /17426596/1157/4/04201.

[12] Rismawati, R., Sinon, I. L. S., Yusuf, I., and Widyaningsih, S. W. 2017. Penerapan Model Pembelajaran Inkuiri Terbimbing Terhadap Keterampilan Proses Sains Peserta Didik di SMK Negeri 02 Manokwari. Lectura: *Jurnal Pendidikan*. Vol. 8(1). Doi :10.31849/

[13] Casselman, M. D., Henbesr, K.A.G., Guregyan, C and Eichler, J. F. 2020. Dissecting the Flipped Classroom: Using a Randomize Controlled Trial Experiment to Determine When Student Learning Occurs. *J Chem Educ*. doi.org/10.1021/acs.jchemed.9b00767.

[14] Akram MT., Ijaz A, and Ikhram H. 2017. Exploring the Factors Responsible for Declining Students’ Interest in Chemistry. *International Journal of Information and Education Technology*. Vo. 7 (2).

[15] Tawil, M dan Lilianasari. (2014). *Keterampilan KeterampilanSains dan Implementasinya dalam Pembelajaran IPA*. Makassar: Penerbit UNM.

[16] Maison, Darmaji,Astalini, Kurniawan and Indrawati. 2019. Science Process Skills and Motivation. *J of Humanities & Social Sciences Reviews*.https://doi.org/10.18510/hssr.2019.756.

[17] Neka, I. K., Marhaeni, A.A.I.N dan Suastra, I.W. 2015. Pengaruh model Pembelajaran Inkuiri Terbimbing Berbasis Lingkungan Terhadap Keterampilan Berpikir Kreatif dan Penguasaan Konsep IPA. *Jurnal Program Pascasarjana Universitas Pendidikan Ganesha*. Vol.1(8), 107-109.