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## The patterns of skills of science process in discovery learning: a case study of science learning in coffee plantation school

To cite this article: K Khusnul *et al* 2019 *J. Phys.: Conf. Ser.* **1211** 012105

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# The patterns of skills of science process in discovery learning: a case study of science learning in coffee plantation school

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**Abstract.** The utilization of local wisdom in an area is very important to maintain the continuity and sustainability of local wisdom in that area. Coffee plantation is one of the local wisdoms in Jember region with the majority of the population earn their living as coffee farmers, so it is very important to combine learning with coffee plantation. Based on the results of the need analysis questionnaire that had been carried out at schools around the coffee plantations in Jember Regency, teachers were not implementing discovery learning that links with the environment, especially coffee plantation. In addition, science process skills were not empowered in the learning process. The purpose of this research was to determine the effectiveness of patterns of science process skills in Discovery learning at coffee plantation areas. The research subjects in this research were VII grade students of SMP/MTs at the coffee plantation area in Jember Regency, Academic Year of 2018/2019. The data analysis used in this research was descriptive quantitative and qualitative. The data of this research were analyzed using Performance Tests. The results of this research showed that the patterns of science process skills in discovery learning can train the students in science process skills. The patterns of science process skills is very effective to train the students in the students' science process skills.

## 1. Introduction

Nowadays, science and technology have grown and developed very quickly, with the impacts that we experience in real on all aspects of life. One of them is science education which has an important role for future life. Improvement and development of science education are still being improved in all aspects of learning. One of the improvements in education is by designing learning models that are appropriate to the surrounding environment by utilizing the local wisdom. The use of local wisdom is one of the initial activities for learning that is shown in the maintenance and utilization of the surrounding natural environment [1]. Jember Regency with its land potential and climate is one of the largest coffee producers in the second place in East Java. In 2013 the amount of coffee production in Jember Regency was 3,105 tons with a percentage increase of 18% [2]. Learning that links directly to the environment in the form of coffee plantation is very helpful for students to be able to more easily understand the material being taught, students are indirectly given insights about coffee and improve the character of students to be able to utilize the surrounding natural environment in this case coffee plantation wisely.

In addition, in line with the empowerment in 21st century education, a number of learning skills must be invested in students, one of which is science process skills. Science process skills are an important basic component of the science learning process and can train students how to gain knowledge [3]. Science process skills consist of basic science process skills and integrated science process skills. Some basic science process skills include observation, classification, measurement, inferences, communication, controlling variables, interpreting data, operationally defining, formulating hypotheses and conducting experiments [4]. Science process skills are used to drive the discovery and development of facts or concepts and attitudes and values [5]. Like study [6], science process skills can add understanding and experience that are important to concepts, scientific propositions and to



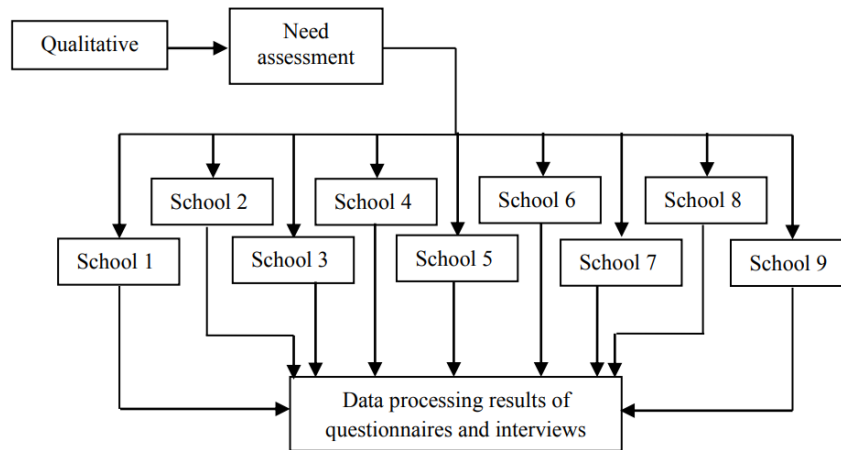
achieve scientific procedure expertise in problem solving and to be applied to everyday life. Science process skills can improve the students' scientific literacy level. This happens because the students are more actively involved in the learning process both physically and mentally through several learning processes including observing activities, raising questions, conducting directed activities, analyzing data, and drawing conclusions [7]. The learning model that is in accordance with the learning process in process skills is Discovery Learning. Where the learning stage used has an effect on increasing the achievement of learning objectives, so as to improve the quality of education. Learning by action increases the students' ability to understand the concepts or material [8].

Discovery Learning is a learning model that conditions the students to be active to act directly in classroom learning. Discovery Learning can characterize the students' learning processes in shaping the students' understanding and managing problem solving, so that the students are active in learning [9]. On the other hand, Discovery Learning refers to the students as explorers, because knowledge is sought and found by the students. Knowledge is found not only from one source but from many sources [10]. Like in study [11], Discovery Learning can make learning become meaningful and student-centered learning. This learning not only can guide the students in understanding the material but can familiarize the students to complete tasks, and enable students to learn not only from the teacher but from various other learning sources. From the statement above, it can be seen that science process skills through Discovery Learning is closely related mainly to the learning process that refers to the learning process which forces the students to be active or conducting the learning process directly so that the students can get the concept or material understanding by themselves. As the study [12], the implementation of Discovery Learning can improve the students' science process skills, for instance, in the stages of stimulation, problem, statement and observation, the students are invited to create a hypothesis.

The success of the implementation of science process skills through Discovery Learning is also influenced by the teacher's ability as the educator. As the study [13], the teacher must have knowledge, understanding and the material needed to teach in the form of science process skills. Besides that, it emphasizes the teacher to cognitively understands science process skills so that the students can reach the skills they want [14]. This research made a pattern of science process skills through Discovery Learning. The pattern was arranged as it is to train the students about science process skills to make the students to get accustomed, understand to do science process skills. In addition, the learning is also conducted by inviting the students directly to the surrounding coffee plantation. This was intended to make the students more understand the material and to make the material interesting and not boring. This research aimed at analyzing the effectiveness of the pattern of science process skills through Discovery Learning on Natural Science learning at coffee plantation school.

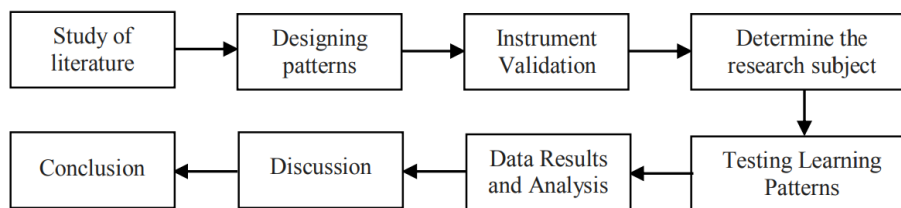
## **2. Method**

This study using a method of triangulation that combines qualitative and quantitative methods. The qualitative method aims to obtain data through observation, interviews, questionnaire, and need assessment on teachers and students, while the quantitative method aims to get the data obtained from the pretest, posttest and rubric tests of science process skills after the application of the pattern of science process skills through Discovery Learning. The independent variable of this study is the pattern of science process skills through Discovery Learning, while the dependent variable is science process skills. The following are qualitative and quantitative methods carried out in this study can be seen in Figure 1 and Figure 2.



**Figure 1.** The Qualitative Method

Based on Figure 1, the steps of the qualitative method consist of the distribution of needs questionnaires and interviews conducted on 9 SMP and MTs in the area around coffee plantations. Distribution of questionnaires is given to designated teachers and students. The distribution of questionnaires and interviews aims to determine the problems by teachers and students. Then data processing was carried out on the results of questionnaires and interviews conducted at schools around coffee plantations.



**Figure 2.** The Quantitative Method

Based on Figure 2, the quantitative method is carried out at several stages, namely the study phase of the study which is adjusted to the results of questionnaires, then design a suitable learning pattern. Then make an instrument in the form of a learning device (Design of Learning Devices, Syllabus and Student Worksheets) which are then validated by experts. Next, determine the research subject and test the patterns of science process skill patterns in Discovery Learning. After that, analyze the results of the application of science process skills in discovery learning, then discussion and conclusions.

The location of science process skills through Discovery Learning was conducted at SMP/MTs which are located at coffee plantation area of Jember Regency. The research subjects of this research were the seventh grade students of SMP/MTs at coffee plantation area of Jember Regency. The results of this research were calculated by using process skills performance test. The measurement of the students' science process skills used performance test by using likert scale from 1 to 5 with the following details: score 1 = very bad; score 2 = not good; score 3 = average; score 4 = good; score 5 = very good with the criteria that can be seen in the Table 2.1. The formula used to calculate the score of the students' science process skills is shown below:

$$K = \frac{\sum ni}{N} \times 100\%$$

Descriptions:

K = the obtained score of process skills

$\sum ni$  = The number of score obtained

N = The maximum score

**Table 2.1** The Observation Criteria of Process Skills

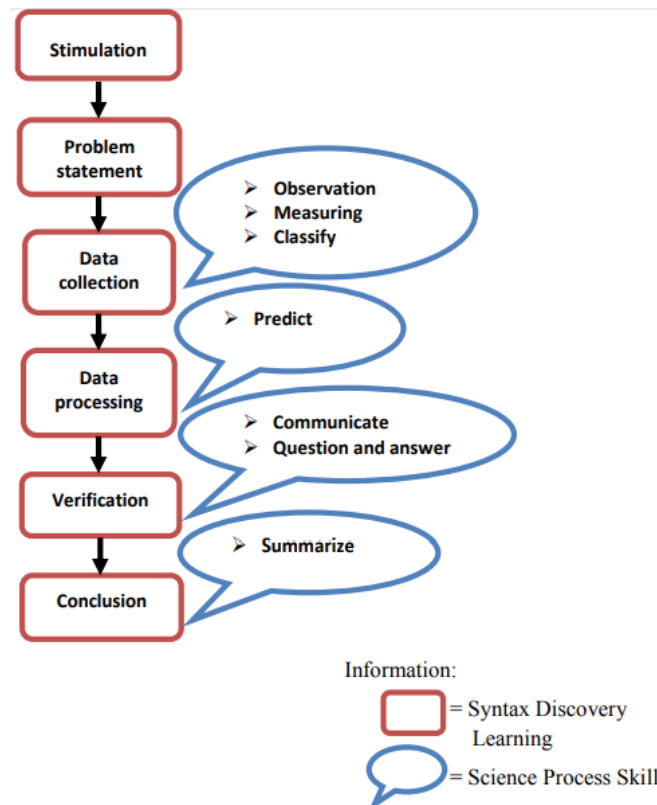
Value Score	Criteria
86-100	Very Good (A)
71-85	Good (B)
56-70	Enough (C)
55-35	Not Good (D)
35-20	Very Bad (E)

### 3. Result

The following are the results of the research conducted, among of them were the science process skills through Discovery Learning, the description of discussion learning in the form coffee plant in the learning and the students; science process skills.

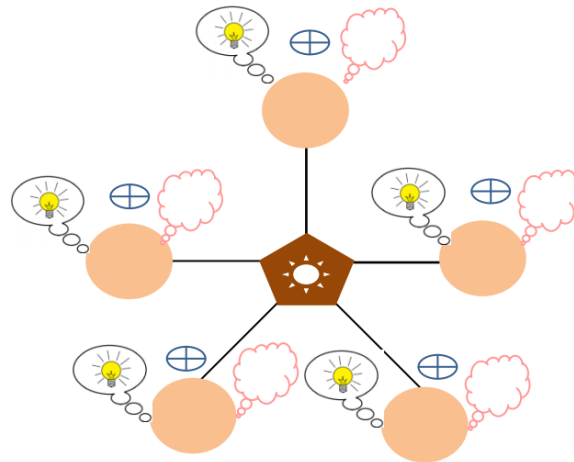
#### 3.1 The Pattern of Science Process Skills through Discovery Learning

The pattern of science process skills through Discovery Learning was made in two designs, in the first design is the combination of design between syntagmatic Discovery Learning and the stages of the pattern of science process skills (Figure 3). In the second design is the figure of the pattern of science process skills through Discovery Learning in the learning process in the classroom.








**Figure 3.** The Pattern of Science Process Skills through Syntax of Discovery Learning

Based on the Figure 3, it can be seen that each point of science process skills will be shown and adjusted with each stage of syntax of Discovery Learning so that in the learning process, the students indirectly will do each point of science process skills.



**Figure 4.** The pattern of science process skills through Discovery Learning

Informasi:

-  = Stimulation from the teacher
-  = Problem Statement
-  = Coffee Plantation Environment
-  = Data Collection. Observation, Measuring, Classify
-  = Verification, Communication, Question and Answer

Based on the figure 4 above, it can be seen that the implementation of each stage of learning in the classroom is students-centered so that the students are trained to learn by themselves, building their own thinking and understanding as well as indirectly train the students to improve their science process skills.

### 3.2 The Figure of Discussion in the Learning

The following Figure 3 is one of coffee plant figures which used by the teacher to give the description to the students about the discussion that they were going to do.

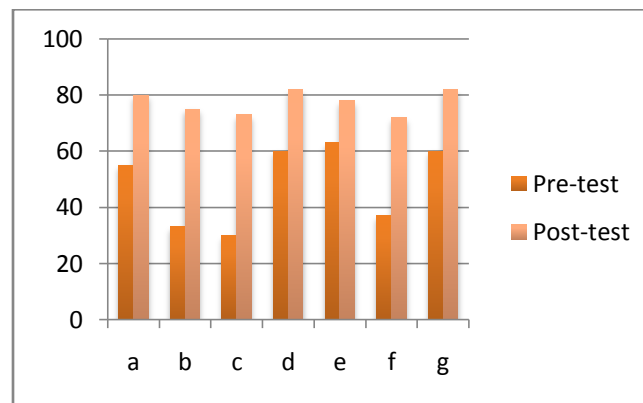


**Figure 5.** The Coffee Plants in their Habits  
(Source: Personal Document)

According to the figure 5, the teacher gave the stimulation to the students by giving them problems, what factors affected the growth of the coffee plant, then how these factors affected the growth of coffee plant. Then, the students made the hypotheses and collected the data directly in the coffee plantation.

### 3.3 The Students' Science Process Skills

The test of science process skill was carried out twice, before learning/treatment (pre-test) and after learning/treatment (post-test). The test results of each point on science process skill and the mean scores of science process skill test can be seen on Figure 6 and Table 3.1.



**Figure 6.** The Results of Science Process Skills Test in Class VII. (a) Observing. (b) Measuring. (c) Classifying. (d) Predicting/Hypothesis. (e) Communicating. (f) Questioning and answering. (g) Summarizing

As shown on Figure 6, it can be seen that the percentage scores on each stage of science process skills increased from pre-test to post-test in class VII. It can be interpreted that from the observing stage, the percentage increased by 25%, measuring the percentage increased by 42%, classifying the percentage increased by 43%, predicting/hypothesis of the percentage increased by 22%, communicating the percentage increased by 15%, questioning and answering the percentage increased by 35%, summarizing the percentage increased by 22%. Hence, it can be concluded that there were relatively high or significant differences on students' science process skills before and after the treatment by being involved in the learning itself.

**Table 3.1** The Mean Scores of t Science Process Skill Test in Class VII. Science Process Skill Before the Treatment (SPS1) and Science Process Skill After the Treatment (SPS2)

No.	Assessment	Average (%)	Interpretation
1.	Science Process Skills Before Treatment	49	Enough (C)
2.	Science Process Skills After Treatment	78	Good (B)

Based on table 3.1, it can be seen that the percentage of the mean scores of science process skill increased before and after the treatment with the mean scores of pre-test as much as 49% and 78% for post-test. From these results, it can be concluded that there were significant differences on students' science process skill before and after the treatment in the learning process.

#### 4. Discussion

From the result of this research, it can be seen that the pattern of science process skill in Discovery Learning which had applied was able to improve students' science process skill. Through this pattern, the students were indirectly treated with several stages on process skills, so that the learning pattern was capable to foster students' science process skill indirectly. In this case, the students were trained to use their science process skills such as observing, measuring, classifying, predicting or making hypotheses, communicating, questioning, and summarizing [4,15]. The learning process of science process skill emphasized them on the process of seeking knowledge rather than transferring the knowledge; in this case, the students became the focus of learning which needed to be actively involved in the learning process and the teacher was only a facilitator to guide the students in the process of learning activities [7]. The pattern of science process skills in discovery learning that is applied in the form of a teacher provides stimulation in the form of a description of problems regarding the description of abiotic and biotic components on coffee plantations. Then the students are directed at determining the formulation of the problem and hypothesis. Then students make observations on coffee plantations to collect data. Then students process data from the investigation with the existing literature. Then the students present, ask questions, and conclude.

The result description of the application of process skill pattern on Discovery learning to students can be seen on Figure 6 and Table 3.1 along with 7 indicators of observed process skills (observing, measuring, classifying, predicting or making hypotheses, communicating, questioning and answering, and summarizing). Based on the results of this research on each stage, the results of skill varied. In the form of changes in the activity began from the initial science process skill (before) to science process skills (after) as it had percentage difference of 30% and categorized as good criteria. It revealed that after the introduction of science process skill training, the students had quite understood science process skill. As it is seen based on each stage, the first stage of observation had the percentage of 80% which was into good criteria, it indicates that the students had enough skills in the process of observing. The second stage was intended to measure the percentage of 75% which classified into good criteria; it shows that the students had enough skills in the measurement process. The third stage was to classify the results with the percentage of 73% as it brought up to good criteria, it means that the students were able to classify the material needed in the learning activities that were carried out. The fourth stage was predicting or hypothesizing with the percentage result of 85% as it became good criteria, it reveals that the students could already find the temporary interpretation of the problem or case in learning. The fifth stage was communicating with the percentage of 78% categorized into good criteria, it shows that the students were skilled enough in presenting their findings and could explain in detail what processes carried out in the experimental activities. The last stage was summarizing with the percentage of 85% of good criteria which showed that the students were able to draw conclusion from the experiment.

The success of the implementation of science process skill was influenced by the teacher's experience in science process skill learning, the more senior and experienced the teacher in the skill of science process, the more successful the implementation and the higher the students understanding [16]. The appropriateness of the used learning model also influenced the improvement of the students' science process skill. This skill could be improved by using the appropriate learning model based on the stages of process skill. Based on the result of this research, the used of Discovery learning could improve the students' science process skill [17]. Discovery learning model is higher than conventional learning. Discovery learning could make the students participate actively in learning process. This was



because the students were given a chance to discover their own knowledge through direct experiment [18]. Moreover, the learning environment also proved to be very effective to the success of learning implementation. The students are invited directly to the real environment and the friendly environment around their life [19]. The students who live in a particular environment, in this case, coffee farm and they used to have activities within the environment, tend to understand the learning material easily. The learning process would be more effective because the students were common with the habitat, population, structure, and shape of coffee plant. The students are easily understand the problem solving, building their own understanding which relates to coffee farm in learning [2].

The implementation of the pattern of science process skill in Discovery learning in this research had significant effect to the students as the result of the research explained in the last paragraph. The significant effect was the students could understand what is meant by hypothesis and they could make a hypothesis independently and correctly. In addition, the students also understand the process of making hypothesis upon a problem given by the teacher. The students were trained to be able to behave and thinking scientifically based on scientific method guidance. The students were also trained do a simple observation and research by using the steps of research procedures correctly. The pattern of science process in Discovery learning also required the students to be more confident and brave to present the result of the observation obtained in the observation. Furthermore, the students were faced to to be stimulated to do questioning and answering so that they could be more active in the class. In the implementation of this pattern, the students became more active and interested to learn and understand the material as well as participated in every stages of learning. Therefore, from this habit building, it could improve the students' science process skill. The utilization of observation in coffee farm also gave significant effect to the success of the learning because by inviting the students to the coffee farm environment, they were challenged and curious to do observation. The utilization of the students' daily knowledge about the environment namely coffee farm is very important to help the success to reach the learning objectives because the students will be more interested in learning [20].

## **5. Conclusion**

From the result of the data analysis, it can be concluded that the pattern of science process skill in Discovery learning could grow and improve the students' science process skill. This could be seen from the improvement of the performance test result of science process skill. The learning pattern directed the students to be active to find and build their own knowledge in the learning process. Thus, this learning pattern could improve the students' science process skill. If the pattern of science process skill in this discovery learning combined with other learning model, would it have more effective result in comparison to the result of this research?

The suggestion of this research is before starts discussion, the teacher should guide the students to read the material beforehand so that when the discussion starts, the students have already had a view of the material. In addition, the teacher should explain the learning steps that will be done to the students so that the learning process can run well and improve the students' science process skill wholefully.

## **Acknowledgments**

We gratefully acknowledge the support from Faculty of Teacher Training and Education - the University of Jember, especially TBL and LSLC Research Group – FKIP-University of Jember of year 2019.

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## Table Of Contents

Early detection of Indonesian financial crisis using combination of volatility and Markov switching models based on indicators of real exchange rate and M2/foreign exchange reserves *N Nafisah, Sugiyanto and H Pratiwi*

Financial crisis prediction in Indonesia using combined of volatility and Markov switching models based on real interest rate on deposit and nominal exchange rate indicators *D Rojanah, Sugiyanto and E Zukhronah*

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Combination of extraction features based on texture and colour feature for beef and pork classification *A M Priyatno, F M Putra, P Cholidhazia and L Ningsih*

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Temperature and strain rate effect on flow stress of al2075/bottom ash composite *F D Supriyanto, H Seputro, H Rinaldi and H I Akbar*

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Solid state organic photovoltaic devices using *spirulina sp* thylakoid membrane films as active material *Q Hidayah, D Y Kusuma, O R Aji, A N Izziyah and B Purnama*

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An analysis of innovation on the utilization of cascara by coffee farmers *N Komaria, Suratno, J Prihatin and Sudarti*