IMPROVING STUDENTS' SCIENCE PROCESS SKILLS (SPS) THROUGH PRACTICUM OF DNA IN BIOTECHNOLOGY COURSES

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Abstract. This study was aimed at investigating university students' ability in inquiry learning. The study involved 7th semester students of a private teacher training institution in Bandung who were taking biotechnology in 2016. The method employed in the study was experimental one with one case shoot study design. Observation sheet was used as data collection instrument. From the three classes observed, the following data was obtained cllas A score 82.5, class B 71.5 and class C 77.5 the average SPS for observation, implementing the concept, designing experiment,interpreting, predicting, asking quetion, formulating hypothesis, playing experiment, using tools, applying concept and communicating with a few students still had difficulties despite regular practices of using the tools in the laboratory. Further study is necessary to be developed and be conducted on participants from different major.

Keyword: inquiry, scientific process skill, DNA isolation, DNA

I. INTRODUCTION

The word "inquiry" is taken from "to inquire", which means to join or to be involved in asking questions, finding information and conducting investigation. It enables students to develop intellectual capabilities related to reflective thinking process. As developing thoughts is the main goal of education, developing ways to achieve the goal is of importance.

Learning is an interaction process among students, teachers and learning resources within a learning environment. Learning is seen as supports given by teachers to enable acquisition of knowledge, skills, and attitude and belief within students. In other words, learning is a process of helping students to be able to learn well.

Although learning and teaching may be similar in several aspects, they have different connotation. In educational context, teacher teach students in order them to master the designated objectives (cognitive aspect), to change their attitude (affective aspect), and skills (psycho-motoric aspect). In that sense, it seems that teaching only involves one party: teachers.

Quality learning depends on students' motivation and teacher's creativity. The combination of both highly motivated students and creative teacher may lead to the achievement of learning objectives. The achievement of learning objectives can be identified from the changes of students' attitude and ability. Given those supportive aspects for learning objectives achievement and with addition of well-designed learning process, would accelerate the achievement of the objectives.

Students' capability is their ability to use their thinking, intelligence and act efficiently and effectively to achieve particular objectives, including creativity. Process is defined as a set of complex skills used by a researcher in conducting scientific research. It is a broad concept which can be broken down into smaller components that should be mastered by a student to conduct a research.

II. RESEARCH METHODOLOGY

The study was conducted on prospective teachers / students as many as 154 students who took the course of microbiology in semester 7 years anjaran 2015-2016 at a LPTK in Bandung in 2017. Consists of 3 classes A, B and C which the average class consists of 50 person. Samples were taken randomly from the 3 classes. The study used a quasi experiment with a one-case study design study. Then observed using observation instruments. The observed observations consist of observation, implementation of the concept, designing experiment, using tools, and planning experiments.

This research employed experimental method with one-case shoot study design. The first step of isolating DNA was to blend the fruit as the source of DNA to break the cell membrane and core membrane mechanically. The next step was to filter the fruit blend and put the extract into solution of detergent and salt. Salt has the same function as SDS in isolation of DNA in white blood cell genome. It gave ionic condition for more stable reaction (Harley, 2005:410). The solution was stirred to avoid it from producing bubbles. It is also to promote larger cell particle and detergent movements for faster reaction as detergent can break cell membrane.

Afterwards, the solution of fruit extract, detergent and salt was put into a reaction tube, given drops of cold alcohol until it produced white ring between the mixture and alcohol.

III. FINDINGS AND DISCUSSIONS

Table 1. The average score Ketrampilan Proses Sains mahasiswa

Observed SPS components		Scores			Description
		A	B	C	
1.	Observing	80	60	75	Observing the result of DNA isolation
2.	Grouping/Classifying	75	70	70	Applying concepts of detergent and salt functions
3.	Interpreting	80	70	80	Choosing appropriate practicum tools
4.	Predicting	80	70	80	Following right instructions
5.	Asking questions	90	60	75	Active or non active
6.	Formulating hypothesis	80	70	70	Make hypothesis
7.	Planning Experiment	85	80	80	Following right instructions Choosing appropriate practicum tools
8.	Using tools and materials	85	60	70	Producing white lumps Communication student
9.	Applying concept	85	75	80	
10.	Communicating	85	80	80	
Average score		82.5	70.5	76.5	Fair

Description: 90-100=very good, 80-89 =good, 70-79=fair, 60-69=poor, <59=bad

Based on the observation along the learning process, class A has average score of 82.5 which means good. Class C's average score (70.5) is lower than other classes and Class B's average (76.5) is in the middle. Class A score 82.5 was good but class B and C poor. So the student in class B and C must be often workshop with practice in laboratory.

Sanjaya (2008:196) explained that there are several key features of inquiry learning. Firstly, it emphasizes students' activity of searching and discovering, which encourage

them to be learning subjects. In the learning process, students do not only act as the one receiving knowledge from the teacher but also have role in discovering the core of the subject being taught. Secondly, all students' activity are geared towards seeking and finding particular matter being taught to nurture their self-belief. In that sense, inquiry approach puts teacher not as the source of learning but as facilitator and motivator for students to learn. As classroom activities are mostly in the form of asking and answering questions, teacher's mastery of asking question is essential in this type of learning. Thirdly, the purpose of inquiry learning is to nurture intellectual capabilities as part of mental process. It suggests that students are not only required to master the lesson but also to utilize all of their potentials in learning.Learning, on the other hand, requires interaction between teacher and students

Rustaman (2003) suggested that the process skill is a skill that involves cognitive, intellectual, manual and social skills. Cognitive skill is involved as in process skill students are required to utilize their thoughts. Manual skill is employed as students need to use and assemble tools and mix materials. Social skill is used when students interact each other in learning process, for instance in discussing observation results. Considering the skills involved, process skill is a good way of learning as it offers real experience of learning through direct experience to the materials being studied.

Science process is a set of complex skills employed by a researcher in conducting scientific investigation. Dahar (1996) elaborated that scientific process skill (SPS) is a student's skill of implementing scientific methods in understanding, developing, and discovering knowledge. SPS is essential for students as basic skills to discover new knowledge or to develop already existing knowledge further. Moreover, Dimyati and Mudjiono (2009) stated that SPS offers the benefitsas follows.

1. SPS could trigger scientific stimuli, which enable students to understand scientific concepts and facts better.
2. It offers students to utilize knowledge instead of only telling or listening for knowledge. It encourages students to be more active.
3. SPS encourages students to learn about scientific processes and products at the same time.

SPS consist of several skills, namely:

1. Observing

Observing is a process of collecting data on particular phenomenon using one's senses. To be able to collect relevant and sufficient facts from an observation, a student has to employ his senses (listening, seeing, feeling, smelling and sensing) to the full.

2. Grouping/Classifying

Grouping is a system of classifying certain items based on particular criteria. It involves activities of seeking for similarities or differences, contrasting features, comparing, and determining basis for the grouping.

3. Interpreting

Interpreting is making tentative conclusion based on the collected data. Observation result would be meaningless without any interpretation. Hence, after observing, every finding is noted and connected with other findings. Then, one can derive some patterns as a basis to draw final conclusion.

4. Predicting

Predicting should be based on reliable observation result (Firman, 2000). If a student can use the patterns derived from his observation and make a prediction of what might happen on

something that he has not observed, then he does have the skill of predicting.

5. Asking questions

The skill of asking questions takes form of asking what, why, how; questions which requires explanation or hypothetical.

6. Formulating hypothesis

Hypothesis is a prediction with particular reasoning as its basis.

7. Planning an experiment

This skill reflects students' ability to choose tools and material to be used in an experiment. They also have to be able to determine the variables: which should be controlled and which should be changed. Furthermore, they should be able to determine what to observe, to measure, or to note, how to conduct an experiment and what steps to be taken. Eventually, they should be able to decide what to do with their observation result.

8. Using tools and materials

To know why and how we use particular tools and material, students need to have direct experience of using them in real experiment.

9. Applying concept

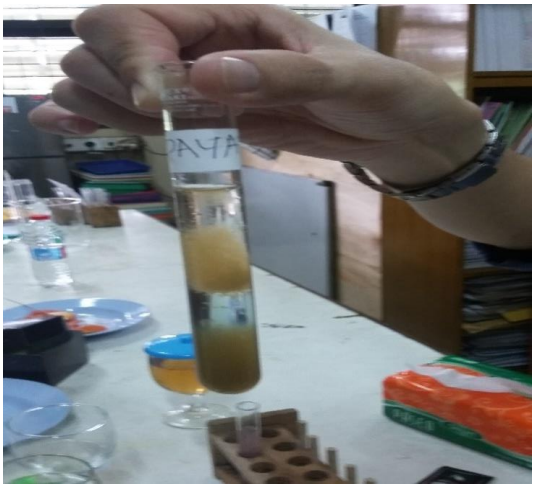
This skill is reflected when a student is able to apply the concepts that he has learned in a new situation or when he applies the concept to explain new phenomenon being researched.

10. Communicating

This skill involves skills of reading charts, tables, or diagrams of an experiment. Describing empirical data through charts, tables, or diagrams is also part of this skill. Firman (2000) defined this skill as skill to communicate ideas or findings to others.

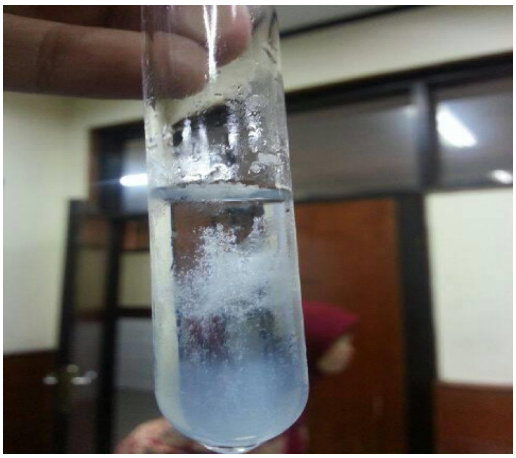
Of all skills comprised above, only observing, applying concept, using tools and planning an experiment were investigated in this study. It is due to the researcher's personal observation that some students were having difficulties in using tools although they had had experiences in using them in several classes. Hence, this study was geared toward addressing whether isolating DNA from fruits could improve students' SPS.

Figure 1. Isolating result of papaya DNA



(Nurkanti, 2015)

Figure 2. Isolating result of banana DNA



(Nurkanti, 2015)

IV. CONCLUSIONS AND RECOMMENDATIONS

It is apparent that the research is not completed as cognitive, affective and psychomotoric aspects have not been measured. However, from the researcher's observation, it can be seen that the students' skill inobservation, implementing the concept, designing experiment,interpreting, predicting, asking quetion, formulating hypothesis, playing experiment, using tools, applying concept and communicating an experiment is relatively fair.

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