

Practicum-Based Science Teaching: Building Students' Concept Mastery, Practicum Skills, and Scientific Attitudes

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Abstract. This study was focused on building concept mastery, practicum skills, and scientific attitudes among eight grade students through practicum-based science teaching. This study employed a one-group pretest-posttest pre-experimental study design. Measurements were performed using a concept mastery test, a practicum assessment observation instrument, and a scientific attitude assessment observation instrument. The results of data analysis revealed that students' concept mastery moderately improved by an average $\langle g \rangle$ of 0.68, practicum skills improved by $\geq 76\%$, and scientific attitudes improved by 89.28%. It can be concluded that practicum-based science teaching could help build students' concept mastery, practicum skills, and scientific attitudes.

Keywords: concept mastery, practicum skills, scientific attitudes, practicum-based science teaching.

1 Introduction

Science education is a product and process. Science products include facts, concepts, principles, theories and laws. While the science process includes ways of obtaining knowledge, developing and applying knowledge that includes how to work, how to think, how to solve problems and how to behave. The ability to apply science concepts in everyday life by Jack Hoolbrok (2009) is called science literacy skills, so it can be said that mastery of concepts and scientific literacy are two things that must be improved.

Wollfold & Nicolish (2004) said that concepts mastery is the ability of students that not only understand but also can apply the concepts given in solving problems even to understand the new concepts. In the learning process with well-structured activities can results an increase in students' concepts mastery (Yang, R, 2006), and through learning based practicum students can get experiences in which students interact with material to observe and understand natural phenomena (Score, 2008). Through learning based practicum processes can also create and invite students to be active in learning activities (Kobierska et al., 2007).

One aspect that was developed in learning science at school is the attitude aspect. According to Reid Gokhale et al., (2009) attitude is "a positive or negative sentiment or mental state, that is learned and organized through experience on the affective and conative responses of an individual toward some other individual, object, or event". According to Martin, et al. (2005) scientific attitudes include (1) the desire to know and understand, (2) ask everything, (3) collect data and give meaning based on the data, (4) demand verification, (5)

think logically, and (6) consider ideas. The attitude developed in science is a scientific attitude that is commonly called scientific attitude. Scientific attitude influences students' willingness to participate in scientific activities (Sorge and Hagerty, 2000).

Integrated science learning has a positive effect and an increase in student learning at science lessons (Becker and Park, 2011). Along with Plotrick et al. (2009) 's research stated that integration across disciplines in science could improve the quality of practical activities skills in the laboratory. This science learning based practicum is expected that students can understand the main concepts and be able to connect between concepts in science subjects. Concepts mastery, process skills (practicum) and scientific attitudes of students in integrated science learning is very important

2 Research Methods

The purpose of this study was to analyze the increase in concepts mastery, practical skills, and scientific attitudes of students as well as the implementation of learning integrated science through learning based practicum on the theme of human respiration. The research method used was a pre-experimental method with one group pretest and posttest design. Data collection tools were used to measure concepts mastery, practical skills, and scientific attitudes of students were tests of concept mastery skills, observation of student practicum skills assessment, observation of students' scientific attitude assessment, and observation of learning implementation. According to Sugiyono (2012), one group pretest and posttest design is a technique to determine the effects before and after giving treatment. The location of this research was conducted at one of the Junior High Schools in Garut. The subjects of this study were 35 students of eight grade class in the first semester of the 2015/2016.

2.1. Research Instrument

2.1.1 Concept Mastery Test

The test instrument used was a written test of an essay. It is based on indicators in Bloom's revised taxonomy C1, C2, C3, and C4, Anderson and Krathwohl (2010).

2.1.2. Observation Sheet for Practical Skills

The observation sheet used is a rubric containing aspects and indicators that have been developed from Science Process Skills (KPS), namely skills in aspects and indicators according to Rustaman (2003). There are 1) aspects of planning experiments/research; 2) aspects of using tools and materials; 3) observing/observing aspects; 4) communication aspects. The measurement scale used is the rating scale (Numerical Rating Scale). This scale is used to measure students' practical skills during the learning process.

2.1.3. Observation Sheet for Scientific Attitude

The observation sheet used was a rubric containing aspects and indicators of scientific attitudes that have been developed by Dimiyati and Mujiono (2006). It includes 1) aspects of accuracy; 2) aspects of honesty; 3) aspects of responsibility; 4) aspects of cooperation.

2.1.4. Observation Sheet of Learning Implementation

This observation sheet is used to observe the implementation of learning based practicum on the material of human respiration (the workings of the lungs with simple teaching aids), the frequency of the lungs, the vital capacity of the lungs and the expiration process by the lesson plan implementation.

2.2. Data Collection and Analysis Techniques

The data collection techniques in this study can be seen in Table 1 below:

Table 1. Data Collecting Technique

Data Resource	Data	Data collecting Technique	Information
Student	Level of concept mastery	Essay test	Taken at the beginning and the end of the learning process
Student	Ability of student practicum skill aspect	Rating scale score	Taken during the learning process
Student	Scientific attitude aspect	Rating scale score	Taken during the learning process
Teacher	Learning implementation	Observation sheet of learning implementation	Taken during the learning process

Data Analysis Technique divided into two things, they are :

a. Validation of Test Instruments.

To get description of students' concepts mastery, good tests are needed. Before being used, the test is tested first to find out the validity, the level of difficulty, the difference and reliability.

b. Data Processing Techniques.

Data obtained are quantitative and qualitative data. Data analysis and processing are based on collected data and research questions. Quantitative data was scored concept mastery test, practical skills and scientific attitudes of students. The steps taken in the data processor are as follows 1) Processing data to measure students' concepts mastery through pretest and posttest. 2) Processing data on student practical skills through observation sheets. 3) Processing students' scientific attitude data through an observation sheet. 4) Processing learning implementation observation data through an observation sheet.

3 Results and Discussion

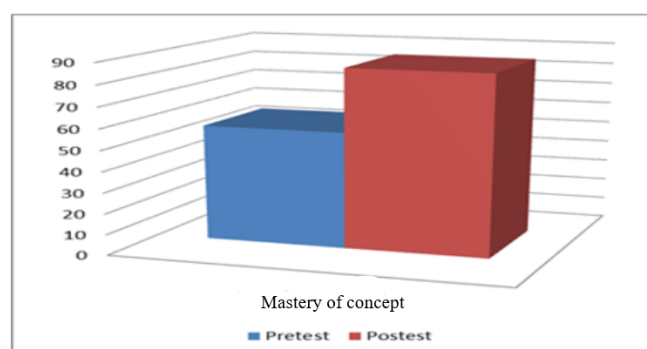
3.1. Improving Student Concepts Mastery

The results of the study generally indicate an increase in students' concepts mastery. The increase can be seen in the data from the results of pretest, posttest, and <g> students' concepts mastery in Table 2.

Table 2. Data Analysis Result of Concept Mastery Test

Test	Ideal Score	Highest Score	Lowest Score	Average	<g>	
					Score	Category
<i>Pretest</i>	30	22	11	16,8	0,68	Moderate
<i>Posttest</i>	30	30	20	25,8		

Based on Table 2. above shows that students concepts mastery has an increase after the implementation of learning based practicum. The increase can be seen on the score of students before treatment (pretest) and after treatment (posttest). Furthermore, to see the percentage increase in students' concepts mastery as a whole can be seen through the graph below,



Graph 1. Average Pretest and Posttest Student's Concepts Mastery

This graph shows that after learning based practicum, students concepts mastery has increased in the medium category. It occurs because of students actively and directly to gain knowledge and understanding of the theory in the learning process. This is appropriate with the results of research findings conducted by Trundle and Atwood (2010) that learning through direct observation students can find a concept and understanding students' concepts scientifically.

3.2. Student Practicum Analysis

This skills aspect was measured with a scoring sheet as Numerical Rating Scale rubric to observe students' ability to carry out practical activities during the learning process by giving scores based on predetermined criteria in each practicum material (Santyasa, 2006). The research sample was divided into six groups to conduct trial/observation activities. The following is a percentage of each skill aspect in the student practicum process for each group shown in Table 3.

Table 3. Average Percentage of Student's Practicum Aspect

No	Skill Aspect	Indicator	Percentage	Category
01	Planning trial/research	Determine what will be carried out / work step	93,88%	Good
02	Using tools and materials	Knowing how to use tools and materials	91,04%	Good
03	Observation	Use as many as sense as possible and collect relevant facts.	83,74%	Good

04	Communication	Arrange and submit report systematically	84,16%	Good
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Table 3. above shows that the overall percentage students' skills aspect in practicum activities is in good category (Arikunto 2010). According to Morrison research (2012), practicum skills use the senses based on working procedures in practical activities, to obtain information from objects or a natural phenomenon. The results of the research by Engler and Russell (2000) are also stated that students who conduct learning through practical activities increased their skills in practicum. Research conducted by Spiro and Knisely (2008) is also said that learning based practicum could develop practical skills and apply concepts.

3.3. Analysis of Aspects of Students' Scientific Attitudes.

The aspect of students' scientific attitudes is measured using the Rating Scale assessment sheet to observe students' scientific attitudes during the learning process. The following is the average score of each aspect of students' scientific attitudes during the learning activities process shown in Table 4.

Table 4. Average Percentage of Student's Scientific Attitudes Score

No	Attitude Aspects	Attitudes Indicators	First meeting	Second meeting
01	Accuracy	Doing trial step correctly/ students can answer LKS correctly	59,28	82,14
02	Honestly	Do not manipulate data and do not copy worksheet result of another group.	55,71	87,14
03	Responsible	Students attitude in reviewing information and applying in experiments and discussion procedure	61,42	90
04	Group Collaboration	Students attitude in collaborating group	62,85	97,85
Total			239,26	357,13
Average (%)			59,81	89,28
Category			Medium	Very high

Table 4. above shows that the results of observations students scientific attitudes during the learning process have increased from the first meeting to the second meeting on each indicator. In the first meeting, the percentage was 59.8% with the medium category, and in the second meeting, the percentage was 89.28% with a very high category (Arikunto, 2010). The same with the research conducted by Kobierska, Fiertak and Grodzinska (2007) that learning based practicum can create conditions where students become able to collaborate and be more active in the process of learning activities. This is by the statement of the Ministry of Education (2006) that practical activities carried out by students during the learning process in the classroom can develop students' scientific attitudes.

3.4. Analysis of Implementation Learning Based Practicum

Based on observers' observations on the activities of teachers in the learning process, they have carried out the learning process and implementation of learning based practicum on the theme of human respiration. It shows that the implementation of learning has been going well and very high.

4 Conclusion

Based on data processing, data analysis and discussion, we can conclude that; in general, Student's concepts mastery has increased through Integrated Science Learning Based Practicum with an average score of $\langle g \rangle$ 0,68 (medium category). Student's practicum skill through integrated science learning based practicum during the learning process take place has percentage $\geq 76\%$ on all indicators of practicum skill in the good category. The scientific attitude of the student's through integrated science learning based practicum during the learning process is increased with an average percentage of 89,28% (very high category). Integrated science learning based practicum has done 100% according to the lesson plan (RPP). The teacher has carried out the learning process and implementation of integrated science learning based practicum on the theme of "Human Respiration", and it was run very well.

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