Learning Cycle-based Ethnobotany: Improving Science Process Skillss for the Pharmaceutical Vocational Students

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Abstract. The present study examines the implementation of learning cycle-based ethnobotany to the concept of plant classification. This study aims to portray the effectiveness of learning cycle-based ethnobotany in improving the science process skillss of the pharmaceutical vocational students and to obtain the students and teachers’ responses about its implementation. This study applies a quasi-experimental method with the randomized pretest-posttest control group design for the students in the tenth grade of pharmaceutical vocational schools around Cirebon Regency. The sampling technique was conducted by cluster random sampling. Then, several procedures of data collection were used which included pretest and posttest, observation sheets to assess the learning process and questionnaires to acquire the students and teachers’ responses about the implementation of learning cycle-based ethnobotany. The data was analyzed through t-test statistics for mean differences. The results revealed that the average values of N-gain for the science process skillss we are 0.402 for the control class and 0.487 for the experimental class. The highest value of N-gain the control class achieved was 0.561 while the lowest value reached 0.093. Both the students and the teachers provided positive responses toward its implementation. In conclusion, learning cycle-based ethnobotany can more significantly improve the science process skillss of the pharmaceutical vocational students than conventional learning can.

1. Introduction
Science process skills are considered to be skills that students must possess as fundamental skills in understanding science. The role of those skills is essential to understand science which is constructed through a sequence of stages called the scientific method [1].

The implementation of science process skills in the learning process urges the creativity of students to learn science at higher level in a shorter time [2]. They find out, develop facts and concepts independently, and improve their attitudes when they employ those skills. Those kind of activities create a more active learning process for the students and they can utilize those skills in daily [3].

Science teachers are advised to build student learning on scientific process concepts and skills rather than just memorizing facts or information [4]. Science process skills have a strong influence on education because science process skills enable students to develop higher learning responsibilities [5]. Science process skills can construct students’ knowledge [6].

At the present time, the conceptual understanding of biology, especially in the concept of plant classification is considered dissatisfied when it is compared with other concepts which are studied at tenth grade in the Pharmaceutical Vocational Schools in Cirebon Regency. It is
proved by the mean scores last year that merely reaches 66 points, while the score of Minimum Master Criterion in each school where the research is conducted reaches 70 points. Based on these results, the teachers should find out an innovative and relevant teaching method which bring up the active role of the students in the learning process. It is necessary to cut off a bad view of the plant classification concept. It is demanded a teaching method where it covers the activities required in the concept of plant classification such as identifying the plants outdoor directly.

Based on the outlines aforementioned, it is necessary to implement a proper and meaningful learning model that involves the participation of the students in the learning process and in which the students can observe the surrounding environment directly. This kind of learning method focuses on science and direct learning, namely learning cycle-based ethnobotany [7].

It is both a planned learning model and a student-centered learning model which consists of several organized stages. It is expected that the students can master the competencies that should be achieved by participating actively in the class. This learning model involves several stages which are redeveloped continually through the research to create an effective learning process both for the teachers and for the students. The stages gradually improve from 3E, 4E, 5E to 7E learning cycle [8] [9].

Research has been conducted by some previous researchers concerning learning cycle to discover the conceptual changes based on a constructivism approach in biology. The results of the study portrays that the implementation of a learning cycle has an effect that greatly improves the students learning motivation [10]. The learning cycle helps students solve problems and, makes it easier for students to learn effectively and organize meaningful knowledge [11]. Besides, this model also helps the teacher to know the students' initial knowledge and avoid misconceptions [12].

In line with the biology curriculum for the tenth grade of the first semester in vocational high schools, the concept of plant classification is taught. This concept is selected because it has a low mean score and it is understood poorly by the students. Mastering the concept of plant classification is required to assist the students in pharmacognition examinations. As a result, the research concerning appropriate learning method as an effort to improve science process skills of the students is required. Based on the observation of the researcher, the problematic issues of the students are lack of participation in the class, lack of enthusiasm to learn, and lack of practicum. Thus, the researcher in the present study attempts to employ a captivating, fun, creative and student-centered learning model, namely learning cycle-based ethnobotany [13]. To sum up, the researcher is interested to carry out a study entitled "Learning Cycle-based Ethnobotany: Improving Science Process Skills for the Pharmaceutical Vocational Students”

2. Methods
In the present study, the participants consisted of the students in the first semester of the tenth grade in two Pharmaceutical Vocational High Schools in Cirebon Regency, namely Khaira Ummah Vocational High School and Muhammadiyah 2 Vocational High School. Both research samples were two out of ten vocational high schools that had equivalent abilities. Both schools were selected with a randomization technique without randomizing the participants themselves. The research samples consisted of each experimental and control group.

Furthermore, this research applied a quasi-experimental method to examine the improvement of science process skills mastery for the concept of plant classification between the students who learned with the learning cycle-based ethnobotany and the students who learned with a conventional learning model [14]. In addition, the research design employed the randomized pretest-posttest control group design where the determination of both experimental and control groups was carried out arbitrarily.
The treatment was carried out by employing the learning cycle-based ethnobotany in the experimental group and the conventional learning model in the control group.

3. Results and Discussion
The results of science process skills (SPS) of students after the learning are shown in Table 1.

Table 1. Score of Pretest, Posttest and N-Gain in Science Process Skills for Experimental and Control Groups.

| The Mastery of Science Process Skills | Control Group | Experimental Group |
|--------------------------------------|---------------|---------------------|
| Pretest                              | Posttest      | N Gain              | Pretest | Posttest | N Gain |
| Maximum Score                        | 11            | 15                  | 0.561   | 13       | 18     | 0.786 |
| Minimum Score                        | 4             | 7                   | 0.093   | 5        | 9      | 0.230 |
| Mean Score                           | 7.029         | 11.68               | 0.402   | 6.265    | 12.00  | 0.487 |
| Percentage of Mean Score             | 38            | 59                  | 33      | 42       | 68     | 51    |
| Standard Deviation                   | 1.471         | 1.583               | 0.141   | 1.508    | 1.755  | 0.132 |

Based on Table 1, it can be seen that the percentage of the mean score for the pretest in the control group reaches 38% of the ideal score which achieves 18 points, while the experimental group is slightly higher at 42% of the similar ideal score. On the other hand, there is a slight improvement after the posttest for both groups when the ideal score does not change. The percentage of the mean score in the control group reaches 59%, while the mean score in the experimental group is 68%. Furthermore, the mean score of N-Gain for science process skills is 33% in control group and 51% in experimental group. The mean score of N-gain for both groups is considered in the moderate level.

Learning cycle-based ethnobotany offers lots of experiences for the students, such as conducting experiments independently, exchanging ideas, discussing with colleagues, and observing and explaining physical phenomena through observation activities [4]. This learning model urges students cognitive, affective and psychomotor aspects [12]. As a result, the results of posttest and N-gain for the experimental group are considered in the high level. Furthermore, it shows that this learning model can assists the students to obtain various experiences of learning, to create new knowledge structure and to realize the importance of scientific practices [3,8]. Thus, this learning model can encourage students to study actively [1,2] as shown in Figure 1.

![Figure 1](image-url)  
**Figure 1** Experiment Gain Diagram and Control of each SPS Indicator

Furthermore, the significant improvement of science process skills of the students for the control group is in the indicator of applying the concept which is at moderate level of N-Gain. This result is
achieved by the competency of the students who master the concept of plant classification for vocational high school level. On the other side, the smallest improvement of science process skills for the control group is in the indicator of communication which is at low level. This poor result is caused by the incompetency of the students to describe the results of their experiments or observations through charts, tables or diagrams and reconstruct the result in other forms.

The learning activities that have been carried out has reflected the implementation of learning cycle-based ethnobotany (Table 2). Most of the teacher activities at each stage of learning process well. The results of observations on the implementation of ethnobotany-based learning cycle learning from activities carried out by students during the learning process are presented in Table 3.

### Table 2 The Result of Observation in the Implementation of Learning cycle-based Ethnobotany toward the Teachers

| Observed Aspects | The Implementation of Learning Cycle at meeting | Mean Score | Mean Score (%) | Category |
|------------------|-----------------------------------------------|------------|---------------|----------|
|                  | Mean score at meeting |                          |               |          |
|                  | I | II | III |                          |            |            |            |          |
| Pre-Activities   |  |  |  |                          |            |            |            |          |
| Eliciting phase  | 5 | 5 | 4 | 4.67 | 88 | Excellent |
| Engaging phase   | 4.1 | 4 | 4.7 | 4.27 | 86 | Excellent |
| Core Activities  |  |  |  |  |      |            |            |          |
| Exploring phase  | 3.75 | 4 | 4 | 3.91 | 79 | good |
| Explaining phase | 3.75 | 5 | 5 | 4.58 | 90 | Excellent |
| Elaborating phase| 4.1 | 4 | 4 | 4.1 | 81 | good |
| Evaluating phase | 4 | 4 | 4 | 4 | 80 | good |
| Post Activity    |  |  |  |  |      |            |            |          |
| Extending phase  | 4.12 | 4.33 | 4.28 | 4.24 | 86 | Excellent |

### Table 3 The Result of Observation in the Implementation of Learning cycle-based Ethnobotany toward the Students.

| Observed Aspects | The Implementation of Learning Cycle at meeting | Mean Score | Mean Score (%) | Category |
|------------------|-----------------------------------------------|------------|---------------|----------|
|                  | Mean score at meeting |                          |               |          |
|                  | I | II | III |                          |            |            |            |          |
| Pre-Activities   |  |  |  |                          |            |            |            |          |
| Eliciting phase  | 4.1 | 5 | 4 | 4.37 | 87 | Excellent |
| Engaging phase   | 4.50 | 4.83 | 5 | 4.78 | 96 | Excellent |
| Core Activities  |  |  |  |  |      |            |            |          |
| Exploring phase  | 3 | 4 | 4.20 | 3.73 | 75 | good |
| Explaining phase | 4.75 | 4.50 | 4.50 | 4.58 | 92 | Excellent |
| Elaborating phase| 4.75 | 4.50 | 4.50 | 4.58 | 92 | Excellent |
| Evaluating phase | 5 | 4.50 | 5 | 4.83 | 97 | Excellent |
| Post Activity    |  |  |  |  |      |            |            |          |
| Extending phase  | 4.25 | 4.25 | 4.25 | 4.25 | 85 | Excellent |

Table 3 shows that learning activities that have been carried out has reflected the implementation of learning cycle-based ethnobotany. Most of the student activities at each stage of learning process run well. Table 4 portrays the student responses of each indicator involving perception, interest and motivation as a result of the implementation of learning cycle-based ethnobotany. Based on Table 4, it is about 84% of the students gave positive perceptions to the implementation of learning cycle-based ethnobotany, and 83% of the students disagreed that learning cycle-based ethnobotany offers negative perceptions. Then, 85% of the students agreed that they were interested with the implementation of learning cycle-based ethnobotany, and 98% of the students strongly disagreed that they lacked interest in its learning. Next, 81% of the students agreed that the implementation of learning cycle-based
ethnobotany urged their motivation to learn, and 93% of the students strongly disagreed that its implementation did not urge their motivation to learn.

Table 4 Percentage of Student Responses to the Implementation of Learning cycle-based Ethnobotany for each Indicator

| Statement                              | Number of Statement | Mean Score | Mean Score (%) | Category            |
|----------------------------------------|---------------------|------------|----------------|---------------------|
| Student’s positive perceptions of      | 1                   | 3.35       | 84             | Agree               |
| learning cycle-based ethnobotany       |                      |            |                |                     |
| Student’s negative perceptions of      | 11                  | 3.32       | 83             | Disagree            |
| learning cycle-based ethnobotany       |                      |            |                |                     |
| Student’s interest in learning cycle-  | 2,16                | 3.24       | 81             | Agree               |
| based ethnobotany                      |                      |            |                |                     |
| Student’s disinterest in learning      | 14                  | 3.91       | 98             | Strongly Disagree   |
| cycle-based ethnobotany                |                      |            |                |                     |
| Positive Motivation due to learning    | 3,4,5,6,7,8,9,12,1  | 3.24       | 81             | Agree               |
| cycle-based ethnobotany                | 3,15                |            |                |                     |
| Negative Motivation due to learning    | 10                  | 3.70       | 93             | Strongly Disagree   |
| cycle-based ethnobotany                |                      |            |                |                     |

Table 5 portrays the teacher responses of each indicator due to the implementation of learning cycle-based ethnobotany.

Table 5 The Percentage of Teacher Responses toward the Implementation of Learning cycle-based Ethnobotany

| Statement                                                                 | Number of Statement | Mean Score | Mean Score (%) | Category            |
|--------------------------------------------------------------------------|---------------------|------------|----------------|---------------------|
| Interest in the implementation of learning cycle-based ethnobotany       | 1,2,3               | 3.1        | 78             | Agree               |
| Preparation of Teacher Understanding in the implementation of learning  | 4,5,6,7,8,9,10      | 3.90       | 99             | Strongly agree      |
| cycle-based ethnobotany (Positive)                                       |                      |            |                |                     |
| Preparation of Teacher Understanding in the implementation of learning   | 11                  | 3.1        | 78             | Disagree            |
| cycle-based ethnobotany (Negative)                                       |                      |            |                |                     |
| Practicum Observation is necessary or unnecessary (Positive)             | 12                  | 3.90       | 99             | Strongly agree      |
| Practicum Observation is necessary or unnecessary (Negative)             | 13                  | 3.90       | 99             | Strongly Disagree   |
| Mean Score                                                               | 3.6                 | 90         |                |                     |

Table 5 shows that the pharmaceutical vocational high school teachers gave positive responses to the implementation of learning cycle-based ethnobotany in the concept of plant classification.

4. Conclusion

There are two major conclusions which based on the result of the research concerning the implementation of learning cycle based ethnobotany to improve the science process skills of the Pharmaceutical Vocational High School Students in the concept of plant classification. The learning cycle-based ethnobotany can significantly improve the students' science process skills as compared to conventional learning. Both the teachers and the students gave positive responses after applying learning cycle based ethnobotany in the concept of plant classification.
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