

The Development of Forest-Prototype Based Learning Model to Activate Students Science Process Skills in Biology Learning

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Abstract

The objective of this research was to produce forest prototype-based learning model. This research and development conducted by using 4D model from Thiagarajan consist of define, design, develop, and disseminate. Syllabus, lesson plan, student's worksheet, activity guidance, observation sheet of science process skill, and evaluation instrument were developed. Learning model testing was conducted in 2 (two) classrooms containing of 106 students. In this learning model testing, students conducted learning with learning forest model in groups according to developed syntax. This activities were observed with science process skills observation sheets. The research results showed that implementation of developed learning model was able to activate science process skills including skills of observing, classifying, measuring, communicating, and inferring. The average of science process skills score form these two try out results is 4.09 (scoring at scale 1-5), similar 81.70%. Based on this result, the researcher recommends teachers to use learning forest model to activate science process skills in biology learning.

Keywords: forest prototype, learning forest model, science process skill

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1. Introduction

Biology learning can facilitate learners more in mastering competence standard if it is conducted in a meaningful learning and empowering science process skill. Meaningful learning means meaningful personally to all students, relating materials to student's experiences in the past, and anticipating future [1,2]. In a meaningful learning, students conduct activities actively and creatively [3,4]. Ministry of Education states that a meaningful learning demands interrelationship between learning in classroom and daily life problems [5]. In this case, a contextual learning which empowers science process skills will provide more productive meaning for learners.

Learning based on science process skills is a learning based on complex ability instruments which is usually used by scientists in conducting scientific investigation in the course of learning process. Learning is designed to give students more opportunities in discovering facts, building concepts and new values through imitating processes to what scientists usually do [6,7]. The process skills approach is a recommended learning for learning sciences including biology. In addition to concept approach, teachers are expected to be able to empower students' potentials with process skills approach. Science process skills is developed

together with facts, concepts, and principles. The cores of science skills process approach are aspects of knowledge (cognitive), attitude (affective), and skills (psychomotor).

Ministry of Education states that science process skills in biology includes basic and integrated skills. Basic skills include skills of observing, classifying, communicating, measuring, predicting, inferring, and interpreting [5]. Integrated skills include abilities of identifying variables, determining operational variables, explaining correlations amongst variables, composing hypothesis, designing procedures and conducting experiments to collect data, presenting experiment results in tables and graphics, discussing, inferring, and communicating in verbal and written forms. Yunus and Hashim suggest that time is also included in science process skills which include activities of describing parameter changes over time, such as location parameter, clues, forms, measurements, weight and mass. Science process skills will facilitate students in formulating questions and finding the answers [8].

Similar to [5] and Corebima [9] state that students in biology learning experience all science process skills such as conducting observation, formulating question, predicting an answer, designing a method to answer a question, conducting experiment, collecting data, analysing data to formulate conclusion, and communicating observation result.

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According to Trilling and Hood [10] and Letsholo and Yandila [11], teachers as facilitators should be able to guide and empower their students, including improving science process skill. Further, Silberman [3] and Corebima [9] prove that the role of teacher in developing science process is very significant. Improved science process skills of student will influence learning conduct; student will develop scientific method, discover and develop facts and concepts, so that learning will be more meaningful in forming character and attitude of being scientific, contextual, and constructive.

Classical-text-based learning model has been widely developed, but not contextual learning to improve science process skill. A learning model was developed in this research, with project initiation based on critical field, which so far has no educational and economic values, to become a forest for learning to be a useful means with educational benefits and this would be able to improve student's science process skill. By this activity, students would think critically, build attitude of environmental concern, be trained in process skill, and be skilful in working and representing cognitive, affective, and psychomotor domains.

The development of forest-based learning to improve science process skills for students in Metro was very contribute to improve living environment issues such as Global Warming, climate change, Let's Go Green program, One Man One Tree program, and Save Our Earth program. In the learning context, this research had synergy with philosophies of constructivism, character building, student-centred learning, collaborative learning, and contextual teaching and learning.

2. Method

This was a Research and Development (R&D) research which was adapted from Thiagarajan [12] with the following steps.

2.1. Define

Defining step was conducted with analysis of concept and need of science process skills and forest-prototype learning which were initiated as learning means.

2.2. Design

Designing was conducted to produce learning design based on forest-prototype-learning before entering development step. This step was conducted to design learning syntax, learning instrument, location map, field activity guide for students, and research instrument to measure science process skill.

2.3. Develop

Developing is realization of designing activity. Development was conducted by composing all instruments,

validation, and testing of forest-based learning model had been mapped before. Learning model testing was conducted in 2 (two) classrooms containing of 106 students. In this learning model testing, students conducted learning with forest-based learning in groups according to developed syntax. This activities were observed with science process skills observation sheets (scoring with 1-5 scales).

2.4. Disseminate

Dissemination step was conducted by socializing result of forest-based learning development results to students and lecturers of biology education to find out, understand, and use forest-based learning as a means to improve science process skills.

3. Results

3.1. Learning Model

The development of forest-based learning model produced learning syntax based on forest-based learning, learning instrument, location map, field activity guide for students, and research instrument to measure science process skills.

3.2. Model Try Out

Model try out was conducted to implement forest-based learning. The first testing was conducted in Plant Morphology subject in classroom A consist of 54 students. All of the students followed course of the learning model syntax. During learning process, observations were made on students' activities of science process skills including activities of observing, classifying, measuring, communicating, and inferring. The average of students' science process skills trained in the forest-based learning model in Plant Morphology subject in classroom A can be seen in Figure 1.

Figure 2 shows the average score of science process skills is 4.06 with the following details. The highest and lowest average scores are respectively observing activity (4.42) and measuring activity (3.58). The average scores of activities of inferring, communicating, and classifying are respectively 4.24, 4.12, and 3.94.

Total average of science process skills score form these two try out results is 4.09 (scoring at scale 1-5). This equals to 81.70%, and this means that the implementation of forest-based learning model is able to produce students' science process skills up to 81.70%. This indicates that classical learning has obtained learning mastery where more 75% of students reached learning accomplishment. Observed science process skilled at learning activities obtains good cognitive learning results. This is similar to Rezba et al., [7] who state that students with good science process skills are expected to obtain good learning results.

Improved process skills makes students conducting learning by developing scientific method, discovering and developing facts and concepts, so that learning will be more meaningful and contextual [1,3].

These research results are in accordance with prior research by Muhfaroyin [13] that in learning biology students need to build thinking structure and activate

science process skill. Thinking levels expected from students in learning biology are levels of thinking orderly and sufficient science process skill, not only material memorizing. Furthermore, Bell [14] suggests that developing reasoning ability need training and biology learning by emphasizing process skills will optimize students' abilities.

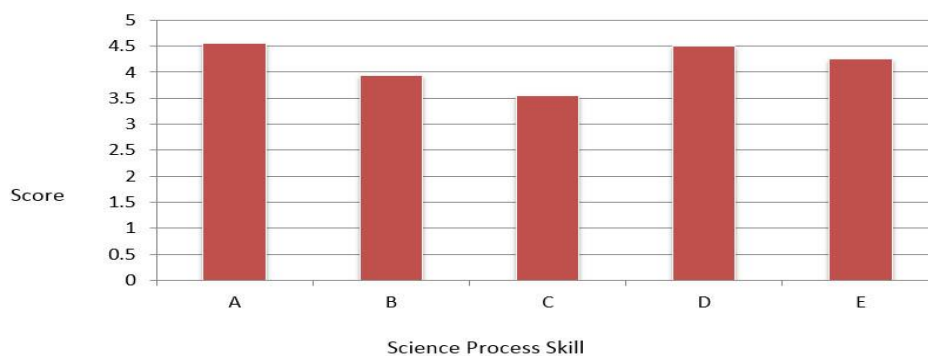


Fig. 1. The average score of students' science process skills in classroom A in forest-based learning model
Note: A: Observing; B: Classifying; C: Measuring; D: Communicating; E: Inferring

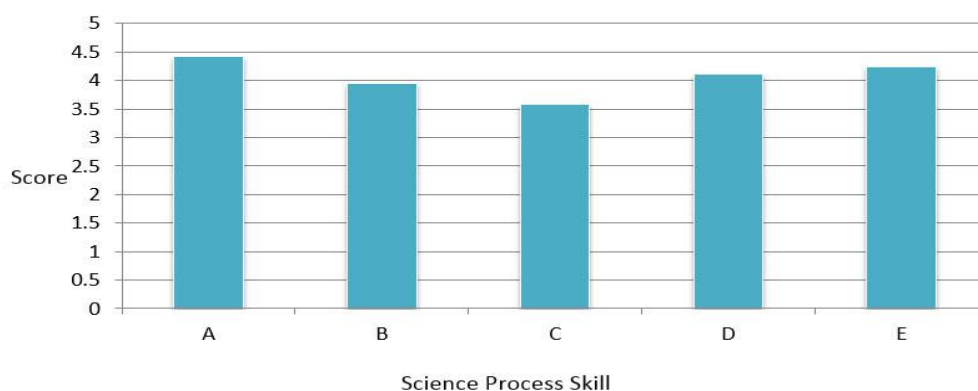


Figure 2. The average scores of students' science process skills in classroom B in forest-based learning model.
Note: A: Observing; B: Classifying; C: Measuring; D: Communicating; E: Inferring

Science process skills able to develop in biology learning includes abilities of observing, classifying, measuring, communicating, interpreting, and inferring [6]. Similar to this, Corebima [9] suggests that in biology learning, students experience all science process skills including observing, formulating questions, predicting answers, designing methods to answer questions, conducting experiments, collecting data, analysing data to infer, and communicating observation results.

By learning which emphasizes science process skill, students do conduct what scientist do such as observing, measuring, identifying and controlling, and experimenting. Science process skills is an approach taken by scientists in their efforts to solve mysteries of nature [6,7]. Further, Muhfaroyin [15] suggests that improved process skills make students to conduct learning by developing scientific method, discovering and developing facts and concepts, so

that learning will be more meaningful, constructive, and contextual.

Forest-based learning can be used as a means of contextual learning for students. Learning biology is not only inside a classroom, but it can be done in the surrounding environment [16]. By this method, students obtain direct experiences from environment about the substance of relevant study to the particular subject and students also obtain direct learning experiences related to environment conditions which require environment concern characters.

4. Conclusion and Suggestion

4.1. Conclusion

Biology learning can be done by using surrounding environment, so that learning will be more meaningful and contextual. From the research results, it can be concluded that forest-based learning model is able to activate 81.70% of students' science process skills.

4.2 Suggestion

To activate students' science process skills, teachers and lecturers may conduct biology learning by using forest-based learning, and because this requires some observers according to students' study groups, the subjects should be handled by some lecturers (teaching team).

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