

Scientific approach as an understanding and applications of hydrological concepts of tropical rainforest

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Abstract. East Kalimantan has a variety of biomes, one of which is tropical rain forests. Tropical rain forests have enormous hydrological potential, so it is necessary to provide understanding to prospective teachers. Hydrology material cannot be separated from the concept of science, for it is needed the right way of learning so students easily understand the material. This research uses descriptive method with research subject is geography education students taking hydrology course at Faculty of Teacher Training and Education, Mulawarman University. The results showed that the students were able to observe, ask question, collect data, give reason, and communicate the hydrological conditions of tropical rain forest biomes, especially related to surface ground water and groundwater conditions. Tropical rainforests are very influenced by the hydrological conditions of the region and the availability of water is affected by the forest area as a catchment area. Therefore, the tropical rainforest must be maintained in condition and its duration, so that there is no water crisis and hydrological related disasters.

1. Introduction

East Kalimantan is a province that has the largest tropical rain forest in Indonesia. The forest consists of conservation forests (1.70466 million ha), protected forests (2,848,243 ha), and production forests (9,123,225 ha). Tropical rain forests of East Kalimantan consist of national parks, Forest Park (Tahura), and forest of natural attractions. Forests are natural resources that can provide double benefit, directly or indirectly benefit. Benefits of the forest are as sources of various types of goods, such as wood, sap, bark, leaves, roots, fruits, flowers and others. One of the functions of tropical rainforest is hydrology. Function of hydrology is very important for human life in surrounding woods and for germ plasm [1].

Hydrological means the forest is a warehouse of water and a place to absorb rain water and dew that will eventually flow into the springs and rivers. Tropical rain forests play an important role in maintaining the circulation of the hydrological cycle. Tropical rainforests can absorb water in large volumes because the trees in the tropical rainforest have long roots and have large trunks of trees that can store large amounts of water. Tropical rainforests are a system of continuously hydrological cycles of water below, on the surface, and on the earth. Analysis on the land-cover changes to the infiltration rates revealed that the older the forest stands, the greater the forest absorbs water from the soil. This proves that the forest stands very well in absorbing water from the soil [2].



In hydrological discussion of tropical rainforest it is required understanding and examples of concrete applications of many found scientific concepts in hydrological material. Understanding and application of the concepts should be taught to the students of geography education who take hydrological courses. Therefore, we need an appropriate learning approach so that students easily understand the hydrological material of tropical rain forest. The approach of learning, in accordance with the material, must also be in accordance with the characteristics of students and involve the student environment as a source of learning. Approach of learning that is considered in accordance with the material, learning objectives, characteristics of students, and environment is the approach of science. The science approach has many advantages over other learning approaches. The advantages are: 1) the students construct the concept through the stages of observing, questioning, collecting data, reasoning, and communicating, 2) providing material understanding through scientific approach, and 3) information not only from lecturers but also from students themselves actively looking for learning resources [3]. The scientific approach helps students arguing that prediction is the ultimate goal that sciences seek [4].

To a degree, we know that we understand (at some level) an event when we can predict the occurrence of that event. Prediction may also permit a substantial amount of control. When events can be predicted accurately, preparation in anticipation of the event can occur, and help us to perfect predictions of our behaviors and thoughts. It is important to note that these assumptions of science are not thought of as true or false, provable or unprovable. As scientists, we make certain assumptions to see where they take us in terms of achieving our goals.

The purpose of this research is to know the effectiveness of scientific approach to improve understanding and application of concept of science on hydrological material of tropical rain forest. In addition to that, this study aims to determine the response of students learning using a scientific approach.

2. Method

This research method uses descriptive methods, which aims to know the understanding and application of concept of hydrological matter of tropical rain forest. The subjects of this study were geography education students Faculty of Teacher Training and Education, Mulawarman University, who took hydrological courses with a total of 31 people. The variables to be studied in this research are: (1) scientific approach; (2) understanding and application of science concept, and (3) moderator variable that is learning style and logic ability.

3. Results and Discussion

One of the study materials in geography education is hydrology. The study material has been adjusted to the basic scientific pattern (PIP) established by the university, namely tropical rainforests and the environment. Hydrological studies include hydrometeorology, potamology, limnology (relatively calm surface water such as geohydrological lakes), and cryology (solid water like ice and snow) and water quality [5]. To be in accordance with PIP Mulawarman University, the hydrological study materials also study the hydrology of tropical rain forest and its impact on human life.

In the hydrological material it is found many concepts of science, especially the mechanical properties of fluid, which study the behaviour of water flow in micro or macro. Fluid Mechanics lays the foundations of hydrological theory focused on the engineering of fluid properties. The topic of hydrology extends in many aspects of science and engineering disciplines, including concepts such as closed flow (pipeline), dam design, pumps, turbines, hydropower, fluid dynamics counts, flow measurements, and open channel flow behaviour such as streams and gullies [6]. The many concepts of science on hydrological material require appropriate learning methods so that students can understand the concept of science and its application. To improve the understanding and application of the concept of science on hydrological material, learning can be done with a scientific approach. The scientific approach matches not only the characteristics of the hydrological material but also the characteristics of the student and student environment. The student centered learning is built on the

principles of learning which consists of active and constructive process as well as social activity, requires mental reflection, uses prior knowledge, and takes of reflection, idea, action, and result [7]. Scientific approach is student centered learning, so students do a lot of activities and this requires high level thinking. The following data are related to the characteristics of students of research subjects.

Table 1. Data subject research

Indegeus	Gender		Learning Style			Logic Abilities		
	M	F	Auditori	Kinesthetic	Visual	Concrete	Transition	Formal
Banjar		3	2	1		3		
Bugis		2			2	2		
Buton	1		1			1		
Dayak	5	2	1	2	4	3	2	2
Flores		1			1	1		
Java	3	6	3		6	4	4	1
Kutai	4	1	1	1	3	4	1	
Paser		1			1		1	
Sunda	1				1		1	
Toraja		1	1			1		
Amount	14	17	9	4	18	19	9	3
Total	31		31			31		

Based on the data of the study subjects, it is shown that subject of women was 55% and that of male was 45%. Most students came from Javanese tribe (29%) and at least 3% students came from Paser, Sunda, and Toraja tribes, respectively. Majority learning style is visual (58%) and the next used learning styles are auditory (29%) and kinestetik (13%). Majority student logic ability is at concrete level (61%) and the next student logic abilities are at transition (29%) and formal (10%). Here are the result of interaction data analysis between learning style and logic ability as a moderator variable.

Table 2. Results of data analysis moderat variable

		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Learning Style *	Kendall's tau-c	.197	.120	1.637	.102
Logic Ability					
N of Valid Cases		31			

Based on data analysis on moderate variables, it turns out the learning style does not affect the ability of logic. The result analysis of student activeness when learning with scientific approach is presented in the following table.

Table 3. Recapitulation of student activity level at learning

Subject	Level Activity						Amount Subject
	Less Active		Active		Very Active		
	F	%	F	%	F	%	
Scientific approach	-	-	5	16	26	84	31
Amount	-	-	5		26		31

When studying hydrology of tropical rainforests using a scientific approach, majority students were 84% very active and 16% active. The results indicate that the students are very active with a scientific approach.

Here is the result of the analysis of the influence of the scientific approach as the independent variable and the moderate style (learning style and logical ability) to the understanding and application of the concept of science as the dependent variable.

Table 4. Influence analysis of independent and moderate variables against tied variables

Group	Mean Difference	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^a	
				Lower Bound	Upper Bound
SA*Auditori	6.927*	2.039	.001	2.900	10.953
SA*Kinestetik	7.609*	2.422	.002	2.826	12.392
SA*Visual	6.055*	1.724	.001	2.650	9.461
SA*Concrete	6.737*	2.165	.002	2.462	11.013
SA*Transision	-6.927*	2.039	.001	-10.953	-2.900
SA*Formal	-6.055*	1.724	.001	-9.461	-2.650

The results of the analysis show that the scientific approach, learning style, and logic ability influence the understanding and application of the concept of science on the hydrological material of tropical rain forest. Significant results are influenced by learning activities in a scientific approach that prioritizes student activities in learning. In a scientific approach, students observe, ask questions, collect data, give reason, and communicate results.

Observation activities were carried out by observing the hydrological conditions in Benanga Dam, Karangmumus River, Mahakam River, Wain River Balikpapan, and artesian wells of residents in the area L2 Kutai Kartanegara. Students understood the hydrological conditions and scientific concepts contained in the hydrological material, i.e.: flow velocity, water pressure, fluid, and capillarity. During the observation, the students also questioned the managers and residents around the hydrological conditions of Wain River Balikpapan and the artesian wells of residents in L2 for 5 - 10 years ago. Thus, students grasped on how the hydrological conditions change over time. In addition to observation and inquire, students also collected river flow data, as well as the distribution and depth of artesian wells owned by residents in L2. Based on observations and data collected by students, the students determined the factors impacting on the hydrological conditions in the tropical rain forest area. After that the students communicate or explain their data and findings on the condition of tropical rain forests and their impact on hydrology and human life, as well as the influence of human activities on the condition of tropical rainforests and hydrology.

Scientific approach is very effective to improve the understanding of science concept to the students, because students construct their own knowledge through scientific activities. The constructive development of new knowledge is based on empiricism and research. Such knowledge leads to the exact reasoning necessary to solve the problems posed by modern life [8]. Modern society requires efficient methods of learning, with emphasis on scientific method [9].

In addition to increase liveliness, the scientific approach also significantly affects the understanding and application of the concept of science [10]. If students understand the concept of science in hydrological material, then students will easily understand the application of the concept of hydrology in everyday life such as fluid, pressure, speed, and energy. This is because students make observations, such as the speed of river flow discharge in the student environment during field lectures. In addition to field observation, the lecturers' learning uses the media of images and video to show and explain the concepts of hydrological material.

The scientific approach is not only done with explanations from lecturers or the use of drawing media, but students also do practicum. This kind of learning activity involves not only one sense but also almost all the students' senses. Students not only hear the explanation of lecturers or see pictures displayed by lecturers, but also student do hydrological practicum. With the involvement of all the five senses of students, the students will better understand the concept of science and its application on the hydrological material of tropical rain forest. By learning such scientific measures, according to Edgar Dale's cone theory of experience [11], the student will remember and understand more if he does with according to everyday life.

In accordance with the purpose of hydrology learning in geography education program, that is knowledge, skill, and application of hydrological values in daily life to the students, the scientific approach gives meaningful learning to the students. The use of learning media, outdoor study, and the early knowledge of students on a scientific approach, help students understand the concept of science and its application with its cognitive structure. This is in line with Piaget's cognitive learning theory, Ausubel's meaningful learning theory, and Vygotsky's social interaction theory [12].

Learning using a scientific approach will help students to remember and understand the material learned, because students play an active role in learning. The findings of this research are supported by study of Adisyah stating that geography learning using scientific approach has significant effect on learning outcomes and geography skills of high school students [13].

4. Conclusions

Based on data analysis and discussion, it is concluded that scientific approach has an effect on understanding and application of tropical rainforest material science concepts to students who have different learning styles and logic abilities. Understanding and application of the concept of science on hydrological material will be easily understood by the students if the learning is adapted to the material characteristics, student characteristics, environment, and learning resources. Students can understand the hydrological condition of the tropical rainforest and its impact on human life. In addition, students understand if the destruction of tropical rainforests will result in reduced and even loss of hydrological functions of tropical rainforests.

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