Description and analysis of physics process on island hilly land for learning the availability of clean water for junior high school students

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Abstract. The surrounding environment has many facts and phenomena that teachers can use as a learning resource for students. The characteristics of land and process physics the inclusion of rainwater into the surface of the soil can be excavating physical concepts to become learning materials. This research aims to measure, analyze and describe the process of physics, infiltration and erosion surfaces and design and implement learning activities outside the classroom. This research uses methods of descriptive analysis. The outdoor research shows that the fastest infiltration process is on grass fields and the largest erosion potential on the open land. The results of the infiltration and erosion measurement of the surface are connected with the concept of science based on the fact phenomenon, implemented to the students with a form of assessment of the process ability and learning group achievement of students seen in the average results, as for the level of diversity of score variation between facts and the overall phenomenon seen from the value of variances. The results of this study became a teaching material as a supporter of science learning design that utilizes the environment in the form of thematic learning.

1. Introduction
Physics is a knowledge that learns physics events that include processes, products and scientific attitudes are cyclic, interconnected, and explain how these natural symptoms are measured through observation and Research. Products are a collection of knowledge that can be of fact, concept, law, principle, and theory. The process is the steps that must be taken to obtain such knowledge as observing, interpreting observations, clarifying, predicting, implementing concepts, planning experiments, communicating and concluding [1]. To make it easy for student to understand the facts and phenomena that occur in nature, there needs to be a habituation of learning to students by utilizing the environment.

Education is just not about how to acquire knowledge. However, education is an effort to enhance the understanding, attitudes, and skills and development of the students. These abilities or competencies are expected to be achieved through various learning processes at school. One of the learning process is through outdoor learning. The learning process in the field is a learning process designed to allow students to learn directly the subject matter of the actual object, thus learning will be more and more evident. Outdoor learning can be in accordance with the program set by teacher [2]. The quality of learning in real situations will give an increase in the capacity of learning achievement through objects learned and to build better social and personal skills. According to Nugroho et al. [3], the outdoor implementation of outdoor learning can improve cognitive learning outcomes of students.
Broadly, according to Elaine et al. [4], the concept of learning using outdoor learning methods has several advantages, such as:

- Student are directly into a world of Congress on the planting of learning concepts, so that students can not only live the material.
- The environment can be used at any time, anytime and anywhere so that it is available at all times, but depends on the type of material being taught.
- The concept of learning by using the environment requires no cost because all have been provided by natural environment.
- Easy to digest by students because students are presented with material that is concrete rather than abstract.
- Students will more freely think and tend to think about the material taught because the material taught has been presented in front of the eye (concrete).

Learning outside the classroom is associated with the concept of democratic learning can support the development of learning initiatives, critical and flexible thinking skills, open and accommodating communication. The concept of democratic learning is part of implementing thematic tasks involving the role of parents and society in the learning activities. Democratic learning provides an important conceptual foundation in the formulation of a thematic task-based learning model. Democratic education according to Medelu [5] quoted from Neil, is learning to students about the environment in which they and teachers are in the community to do learning activities. Democratic learning is related to thematic learning which is interpreted as a concept of a learning approach that involves several subjects to provide a meaningful experience for students. Thematic learning is a learning model related to several pedagogic methods such as studying outside of classroom learning, team teaching, and learning Communities [6].

Based on the results of the interview, researchers have been informed that research subjects (learners) have difficulty learning science lessons because of what student learn in school, they cannot apply in the environment where their lives. This is because in junior high School 2 Tatoareng no teacher of science subjects and who gave science lessons for student is an social teacher, so that the learning process science in this school is less pleasant, because the model Learning that teachers apply less interesting, learning processes that rely solely on textbooks, and learning media used is not varied, the environmental utilization is less optimal in science learning, the environment is only as object in learning without knowing the cultural values embodied in science learning. As an example of the island's hilly conditions there are many concepts of physics in it obtained through observation by each group of student, one of which is the measurement of infiltration capacity. Measurement of infiltration capacity is important to know the ability of the land in channeling water down the surface and finally can indicate groundwater availability. Because there are several types of soil that has small infiltration capacity it causes the absorption power capability of the surface to be difficult so that we need the installation of biopri [7].

The measurement results of infiltration and estimation of groundwater availability, associated with empirical experience of the community in the utilization of clean water can reflect the importance of ecosystem management including the role of community in the preservation of sources Water power. This research can also help to improve the understanding and awareness of people in the forest as the storage of groundwater availability. Because various human activities such as logging for the uptake of the forest functions and the transfer of forests into an ongoing plantation can have an impact on biodiversity and ecosystem functions. Therefore, floristic studies are indispensable before the extinction of plant species that are likely to be of potential information and its usefulness has not been much expressed [8]. Forest is one of the supporting factors in increasing infiltration capacity, improving soil physical properties such as structure formation and increased porosity [9]. Learning about the water cycle, especially the availability of clean water is important for students to understand the process of infiltration, groundwater availability and forest ecological functions for community life, but there are no relevant teaching materials to Expanding the knowledge of students around the island, related to all natural phenomena in the residential area. Therefore, this research is designed to develop learning related
to the physics process of water distribution to the subsurface of the land to ensure water supply for the community.

2. Materials and methods
This research is part of collaborative research with the kind of development of teaching materials sourced from facts and phenomena of the environment. The research method used in this research is a method of analytical and descriptive research, which became the focus to be described is the hilly land of the island as a learning availability of clean water to be further designed Materials and learning activities in the field by developing students' group skills in observing and measuring related facts and phenomena. The subject of this study are students of grade VIII and IX Junior High School 2 Tatoareng and taken 34 students.

The variables measured in this study are as follows:
- Surface erosion, by means of observation in the rainy season and also conduct experiments by measuring the volume of surface materials that drift the unity of land area.
- Measurement of infiltration rate and land infiltration capacity determination. Measurement of infiltration rate using double infiltrometer with high water surface between two cylinders is fixed.
- Measurement of soil moisture and soil pH using Soiltester tool

2.1. Stage of research
This research includes two components or focus of research that is: a. research condition/characteristics of land and process physics the water distribution of rain into groundwater, b. research studies on the process of physics related to the availability of groundwater/water in a residential area.

2.2. Analysis techniques of data
Using quantitative and qualitative analysis. Quantitative analysis includes: a) The intensity of group interactions (based on group interaction indicators), B) Science process skills (based on the data of observation results), c) The achievement of the concept learning-mastery and procedural knowledge (Response data in the learning process, activity reports, tasks in the field). Form analysis and quantitative descriptions include percentages, lamination and variances, trend progression of group scores, correlates (conceptual and procedural knowledge, as well as intensity interactions with group assignment scores). Qualitative analysis is used for the evaluation and description of climate development of learning groups and student perception of materials and learning activities.

3. Results and discussion

3.1. Description of research results
The analysis and assessment of the observation and measurement data of all groups are based on the format of the material design and the learning activities designed by the research are used as a reference for learning outside the classroom. The learning and assessment Data of all groups can be seen in Table 1.
Table 1. Group learning outcomes 1-4.

| Facts and phenomena | Number of learning activities | Group 1 | Group 2 | Group 3 | Group 4 |
|---------------------|-----------------------------|--------|--------|--------|--------|
| Surface erosion of sloped land | 24 | 66 | 51 | 45 | 59 |
| Puddle of water on flat ground surfaces | 11 | 33 | 27 | 29 | 32 |
| Vegetation area and open land areas | 11 | 30 | 27 | 28 | 30 |
| Surface flow on clay and sandy soils | 12 | 36 | 32 | 33 | 35 |
| Surface flow on clay and sandy soils | 12 | 36 | 31 | 28 | 36 |
| Total | 70 | 201 | 168 | 163 | 192 |
| Average | 2.87 | 2.4 | 2.32 | 2.74 |
| Varian’s | 0.11 | 0.33 | 0.36 | 0.19 |

According to Table-1 above the results of the study of the group seen from the average value, which obtained the highest average value is group 1 with a value of 2.87 indicates that group 1 is able to master the concept of science from the design of material Taught though still very simple. Group 3 got the lowest average value of 2.32 that means this group has not been able to master well every concept of science in material design. But the acquisition of average values from groups 1 – 4 is not very different because it is seen based on the results of variance calculations indicating the diversity of scores between phenomena can be mastered by each group. The average value of learning process and student group learning is assessed based on the results of a design assessment of learning development activities designed by researchers through field observations and public interviews Conducted together with the lecturer team. The Format of the learning development in it is a learning process and learning access prepared by researchers based on the assessment rubric that has been created by researchers. Based on the results of the calculation of the average value then it can be known the results of the group's ability to implement the design of learning activities outside the class as shown in the following Figure-1.

Figure 1. Graph of the average value of the process and learning achievement of Group1-4.

3.2. Discussion

Based on the results of research that has been carried out in the island of Para especially in Paralelle village in SMP 2 Tatoareng regency of Sangihe Islands, the development of teaching materials in the field of learning activities that are designed by researchers there are some Students consider a new thing,
because students can learn directly in nature. During this time the science learning activities in junior high School 2 Tatoareng is very limited because there are no educators who have a background in education from the field of science or science. Through the researchers' observation of the students, the learning motivation that existed in the students was also very little due to the lack of support from parents because the average students in this school did not live with parents Most of their parents wander the urban areas. This research activity is related to the design of materials taught to learners.

The process of in-field learning is designed to be done through observation, measurement and involve the role of parents, teachers, and society in order to add a source of information related to learning designed. This is supported by the results of research conducted by Jeane [10], namely when conducting learning activities outside the classroom, there is good support from learners, teachers, parents and even society. Student are directly involved in learning activities outside school hours to identify natural facts and phenomenon and are associated with the concept of science. The activities of these students are supported by parents and communities such as participating in the identification of elements that support learning (concepts of science and mathematics), participating in the formulation of instrument processes and achievements Learning, participating in learning activities, such as analyzing the function of equipment and the concept of related mathematics science, analyzing the process of change physics that occur during the traditional machete. Students learn together in their respective study groups and are supported through the roles of parents, teachers and communities to further enhance the learning outcomes of the students. It is supported by Akanmu and Fejenidagba [11] and Hackathorn et al. [12] stating that the study performed together will show more effective learning outcomes than in individual learning or method of lecture.

This study focuses on learning about the process physics the rain water distribution to the groundwater studied through observations and measurements related to facts and phenomena of erosion and infiltration in the island Para associated with the concept of science, where learners are faced with new and different learning situations. Learners are challenged to be able to acquire new discoveries in developing their own potential. According to the research results of Nastiti et al. [13]; Marianus and Patricia [14] who stated that learning by using the discovery process will be able to increase understanding of concepts and problem-solving skills by learners.

Through new experiences, learners strive to obtain information from the community and improve the skills that exist in the students, in which case students perform observations and Measurements in plantation areas and resident settlements in Para Island. This form of research is supported by the research of Lahete [15] where students learn directly from nature and try to think critically to connect between facts and natural phenomenon with the concepts of science but research from Lifting theme about the water cycle. In the results of measuring the actual infiltration of the form of learning Shiva can determine the magnitude: initial infiltration rate FO, the rate of constant infiltration of FC and the length of the process of infiltration t which can be made graphs that are functions Exponent [16] but because the subject of research is a junior high school student whose knowledge of mathematics is still limited so as to learn the infiltration process is based only on the category of fast speed, less fast and slow.

The result of an assessment of the group's process of learners in working on the tasks given on the Learning Plan related to the facts and phenomena of nature erosion in the slope and water on the flat land is good, although there are most participants Students who are the subject of research are unfamiliar with identifying or describing the relationship between facts and phenomena with the concept of science, and yet can distinguish between facts and phenomena, but after being guided by the research team. They can work on every given task and be able to make improvements so they can understand and get good results. There are 70 forms of learning activities designed by researchers sourced from 5 facts and natural phenomena and there are 20 concepts of physics that are examined from the facts and phenomena of the natural phenomenon. In the implementation of learning activities there are several activities with the same theme implemented simultaneously. After the student study Group conducted 70 learning activities, researchers summarized the results of the process and group learning through average values and variances. Average value acquisition is intended to see the level of process ability and student
learning achievement of material development design and learning activities while the value of variance is intended to see the varying rate of variation in scoring scores between facts and phenomena as a whole. Based on the results of the summary assessment process and learning Group 1 received an average rating of 2.87 and a value of 0.11 variances. Group Two with an average value obtained 2.4 and a value of variances 0.33The group of three with the average value obtained is 2.32 with a value of variance 0.36. The group of four with the average value obtained is 2.74 and the value of variances 0.19.

The average value and process variance and student group learning are assessed based on the assessment in the development of learning activities designed by the researchers together with the lecturer team, based on the rubric. The assessment that has been made by researchers.

Based on the results of the study design through facts and natural phenomena associated with the concept of science on the theme of clean water availability, that almost some members of the group still experience obstacles in conducting observations and measurement through the science process but there are members who already understand what they are doing according to the study plan provided by the researcher. Through the acquired values can see that the learners are able to work on each given task even though it is not too active and there is no good cooperation between the individuals in the group. There are also several indicators that learners cannot meet for example describing the facts and natural phenomena that they encounter in their activities into the science concept, Learners are also still not much understanding the implementation of the concept of designing in the environment because the previous learners are not accustomed to perform such activities. Although some indicators have not been met but the result of the final value of each group is good based on the acquisition of variances whose value does not differ considerably, it signifies that all groups can work and master the design of the learning well.

4. Conclusion

The results of infiltration and surface erosion measurements on open land, grass areas and tree areas indicate that the fastest infiltration process is in the area of grass and the biggest erosion potential on open land. The process of rapid infiltration in the areas of the grass due to the influence of vegetation that helps the process of water entry into the soil. In the measurement of surface erosion in the open land the amount of material that is washed more because on open land there are no plants that give a force to the water flow and also hujanbertumnot directly with the ground surface without barriers by plants. The more sloping potential land erosion is getting higher and the less infiltration process.

From facts and natural phenomena, it can be formulated into the concept of physics to be designed as a thematic task material and become a source of learning for junior high school students. The design of material sourced from the facts and natural phenomena is implemented to the students to add mastery of the science concept of the students. The final value of the student group is good and students are also able to describe facts and natural phenomena into the concept of physics, although it is still very simple.

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