An analysis of the understanding of physical education students on the environmental physical concept in landslide matter

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Abstract. Physics is a branch of science that discusses natural phenomena with all their physical dynamics such as mass, energy, momentum and physics concepts that exist in our environment which are related to landslides. The problem is how much understanding of students in dealing with landslide natural disasters. This study aims to describe the understanding of physical education students on environmental physics concepts in landslide material. This research was conducted in the Physics Education Study Program. The research subjects were 30 students of the physical education study program class C class 2017. The data collection instrument used was a multiple-choice reasoned amounting to 15 items accompanied by CRI to determine the level of confidence of the research subject in answering the questions. The test result data is then analyzed to determine the percentage understanding of the concept for each given question. The results of the analysis of respondents' answers regarding the conceptual understanding test on the concept of environmental physics in the landslide phenomenon showed that the level of understanding of the concept of students was classified as sure that they understood the concept, namely moderate with an average percentage of 41.98%, an average misconception of 29.79%, and not understanding the concept of an average of 29.03%.

1. Introduction

The phenomenon of natural disasters in the form of landslides is a sudden natural event that begins with several conditions, so that preparedness from humans is needed[1],[2],[3],[5]. Therefore, humans must understand these conditions in order to be prepared in the face of crises, disasters or other emergencies[4],[7],[8],[9].

Preparedness is an activity to anticipate disasters through organizing, appropriate and efficient steps[10],[11], and aims to minimize the side effects of hazards through effective, timely, adequate preventive measures, efficiency for emergency response and assistance during disasters[12],[13],[14].

Knowledge of disaster is the ability to remember events or a series of events that threaten and disrupt the lives and livelihoods of people caused, either by natural factors and/or non-natural factors or human factors that can result in human casualties, environmental damage, property losses, and psychological impact[9],[11],[12],[17].
Knowledge is the result of "knowing" people after doing sensing (eyes, ears) on a particular object[3],[4],[9]. Mastering means that learning physics must make students not only know and memorize concepts but must make students understand and to understand these concepts and connect the relevance of a concept to another concept [14],[16].

Physics is a branch of science that addresses natural phenomena with all physical dynamics such as mass, energy, momentum and other physical concepts[14]. Therefore, students must be able to use all the ability to think and do learning effectively and efficiently to get optimal results[15],[16].

Environmental physics learning related to the problems of landslide phenomena that exist in our environment can be minimized, so that the existing problems are very important shared responsibilities[3],[12],[13].

The low understanding of the concept of student physics is due to the understanding of people who are influenced by their interpretation of a fundamental concept of a concept of environmental phenomena[17][21]. Students come to class carrying initial knowledge about a concept or an explanation of a phenomenon as they see it[5]. Sometimes the explanation of these interpretations is not following scientific explanations[11],[13].

The cause of the misconception was caused by the resistance of a concept that was built by people based on their wrong experiences. Therefore, it is not easy to tell that this is wrong by just telling to change the misconception found in everyday life[16].

The results of the study state that the characteristics of preparation for physics teacher candidates must meet the following standards: (1) study physics with the same method when he teaches, (2) get knowledge about how students learn and how they study physics, (3) involved in the same learning environment with the environment that he wants to create when teaching, (4) complete mastery of technology, methods, skills that they will use in class, (5) learn how to involve students in scientific work practices, (6) understand concepts and their application flexibly, (7) understand the process of thinking physics, reason qualitatively and quantitatively about processes and laws of physics [5],[14].

Based on the results of the above studies, the researchers conducted a study of the understanding of environmental physics analysis on the concept of the landslide phenomenon of students of the Physics Education Study Program at Tadulako University, Palu.

2. Methods
This research is qualitative research whose data is in the form of facts so that in this study, a qualitative descriptive approach is used[19],[20]. The type of research used in this study is a case study. The subjects of this study were students of the 2015 class of physics education study program, totalling 30 students.

The purpose of this study is to describe the understanding of student concepts in landslide phenomenon material. The instrument used in this study is reasoned multiple-choice, accompanied by a CRI column (Certainty of Response Index)[6]. In this study, interviews were also conducted to explore the abilities and errors in more depth in analyzing problems related to the existing material[18].

| Table 1. CRI and Its Criteria [6],[15] |
|---|---|
| CRI | Criteria |
| 0 | I really don't know |
| 1 | Little know |
| 2 | Not sure |
| 3 | A little sure |
| 4 | Sure |
| 5 | Very sure |

In particular, questions in multiple-choice tests, for example, respondents were asked to choose an answer that was considered correct from the available options, giving a CRI, between 0 - 5, for each
answer chosen[6],[18]. CRI 0 is asked if the answer is chosen the result of pure guesses, while CRI 5 is asked if the answer has been chosen based on the knowledge that he believes is correct[15],[16].

Table 2. Criteria for Grouping Student Answers Based on CRI [6],[18]

| Answer criteria | Low CRI (<2.5) | High CRI (>2.5) |
|-----------------|----------------|-----------------|
| Correct answer  | Correct answer but low CRI means not knowing the concept (lucky guess) | Correct answers and high CRI means mastering the concept well |
| Wrong answer    | Wrong answers and low CRI means not not knowing the concept | Wrong answer but high CRI means misconception |

Table 2 shows four possible combinations of (true or false) and CRI (high or low) answers for each respondent individually. For a respondent and a given question, the correct answer with a low CRI indicates not knowing the concept, and the correct answer with a high CRI indicates a high mastery of the concept. The wrong answer with a low CRI indicates not knowing the concept, while the wrong answer with a high CRI indicates a misconception.

3. Results and Discussion

3.1. Results
The results of the analysis of respondents' answers regarding the conceptual understanding test on the concept of landslide phenomena tested in 2015 physical education study program students were 30 students as follows:

![Figure 1. Identification Chart Understanding the concept, Not Understanding the Concept, Misconception funds](image-url)
### Table 3. Student Answer Descriptions

| No | Key/ CRI | Answers Description | Concept Understand | Misconception |
|----|----------|---------------------|-------------------|--------------|
| 1. | B/5      | Because excessive water absorption due to high rainfall can cause rock damage because the water content is acidic which can damage rock chemistry. | 6.7% | 30.0% |
| 2. | C/5      | Because the weathered rock will be pulled material by gravity (weathering results) to a lower place and cause landslides, as a result of moving soil mass due to unstable gravity is not a cause of the phenomenon of landslides. | 26.7% | 40% |
| 3. | A/5      | The action of soil degradation described in the soil can reduce soil fertility levels and not increase the concentration level of soil nutrient elements | 40.0% | 23.3% |
| 4. | D/5      | Because the erosion process does not affect rainfall | 46.7% | 30% |
| 5. | C/5      | Because of the order of the right hydrological cycle, namely:  
- Evaporation ... evaporation by water throughout the surface of the earth.  
- Purchase ... evaporation by plants.  
- Condesa's ... the formation of clouds.  
- Precipitation ...... it rained | 40% | 16.7% |
| 6. | A/4      | It is because there is a small number of trees that cause the water content in the air to be raining a little. | 50% | 40% |
|    | A/5      | The water point will be damaged if there is little rainfall because the water content in the air is small. | 36.7% | 50% |
| 7. | B/5      | The smoothness of the hydrological cycle due to landslides is not affected by the rainfall absorbed by the trees, so that the environment is drier but, on the contrary, if the rainfall absorbed by the trees decreases, it causes a drier environment. | 36.7% | 50% |
|    | B/4      | Rainfall absorbed by trees increases so that the actual environment will become drier. It will not damage the hydrological cycle. | 40.0% | 23.3% |
| 8. | A/4      | Increased river water quality is not an impact of damage to the hydrological cycle to the environment, but three other statements are the impact of the damage to the hydrological cycle. | 40.0% | 23.3% |
| 9. | C/3      | Large-scale reforestation is carried out so that many trees absorb rainfall and can produce clean water by making reservoirs of water in the soil. | 66.5% | 20.0% |
| 10 | C/5      | The total difference in contour height can be done automatically by using RBI digital maps and ArcView programs. | 90.0% | 0.0% |
|    | C/5      | The total difference in contour height in map units (h) and the horizontal distance of map units (l). Meanwhile, if done automatically, with RBI digital maps and ArcView programs. | 13.3% | 66.7% |
| 11 | D/4      | Influence the development of the host rock type as a guideline in making the Geological map of the watershed. | | |
Ground cover plants have the role of holding or reducing the destructive power of falling raindrops and the flow of water above the ground, adding soil organic matter through fallen stems, twigs and leaves, and transpiration, which reduces the soil water content. The role of these cover crops causes a reduction in the dispersion strength of rainwater, reducing the amount and speed of surface flow and increasing the infiltration of water into the soil, thereby reducing erosion.

AMDAL must carry out massive water use, and it is recommended to use water in a compressed aquifer

The use of land for agriculture is limited because of evaporation (evapotranspiration) in the surface water of the earth and plants for the needs of the active hydrological cycle because of the warmer tropical climate.

Rehabilitation of infrastructure programs and the density of settlements that are threatened with problems due to the density of natural disasters

| No | Key/ CRI | Answers Description                                                                 | Understand | Misconception |
|----|----------|-------------------------------------------------------------------------------------|------------|---------------|
| 12 | D/4      | Ground cover plants have the role of holding or reducing the destructive power of falling raindrops and the flow of water above the ground, adding soil organic matter through fallen stems, twigs and leaves, and transpiration, which reduces the soil water content. The role of these cover crops causes a reduction in the dispersion strength of rainwater, reducing the amount and speed of surface flow and increasing the infiltration of water into the soil, thereby reducing erosion. | 50,0%      | 20,0%         |
| 13 | B/5      | AMDAL must carry out massive water use, and it is recommended to use water in a compressed aquifer | 43,3%      | 30%           |
| 14 | A/3      | The use of land for agriculture is limited because of evaporation (evapotranspiration) in the surface water of the earth and plants for the needs of the active hydrological cycle because of the warmer tropical climate. | 13,3%      | 33,3%         |
| 15 | D/3      | Rehabilitation of infrastructure programs and the density of settlements that are threatened with problems due to the density of natural disasters | 16,5%      | 50,0%         |

Table 4. Description of CRI Student Answers

| Problem No. | Concept | Understand | Misconception | Do not Understand |
|-------------|---------|------------|---------------|------------------|
| 1           |         | 36.7%      | 30.0%         | 33.3%            |
| 2           |         | 46.7%      | 20.0%         | 33.3%            |
| 3           |         | 40.0%      | 23.3%         | 36.7%            |
| 4           |         | 46.7%      | 23.3%         | 30.0%            |
| 5           |         | 40.0%      | 16.7%         | 43.3%            |
| 6           |         | 50.0%      | 40.0%         | 10.0%            |
| 7           |         | 36.7%      | 50.0%         | 13.3%            |
| 8           |         | 40.0%      | 23.3%         | 37.7%            |
| 9           |         | 66.5%      | 20.0%         | 13.5%            |
| 10          |         | 90.0%      | 00.0%         | 10.0%            |
| 11          |         | 13.3%      | 66.7%         | 20.0%            |
| 12          |         | 50.0%      | 20.0%         | 30.0%            |
| 13          |         | 43.3%      | 30.3%         | 26.4%            |
| 14          |         | 13.3%      | 33.3%         | 53.4%            |
| 15          |         | 16.5%      | 50.0%         | 33.5%            |

3.2. Discussion

Data from the research shows that the level of understanding of the concept of students is classified as low, with an average percentage of 37.3%. Meanwhile, students who do not understand the concept are classified as high with an average percentage of 41.98% and students who experience misconceptions with an average percentage of 29.79% and do not understand the concept of 29.03%.

The results of the analysis of the description of student answers to each question based on CRI are as follows:

Problem number 1: Stating that students who understand the concept of the phenomenon of high rainfall will accelerate chemical reactions so that chemical weathering is more intensive. Groundwater
absorption caused by high rainfall is a factor causing chemical weathering, amounting to 36.7%, misconceptions of 30%, and those who do not understand the concept of 33.3%. In connection with that, students belong to the category rather sure to understand the concept.

Problem number 2: Identify that the average student who understands the concept of landslide phenomenon occurs when the driving force on the slope is greater than the retaining force. Retaining forces are generally influenced by rock strength and soil density, while the driving force is influenced by the magnitude of the slope angle, water, load, and soil or rock specific gravity. So that the movement of soil mass due to unstable gravitational forces is not a cause of landslides, amounting to 46.7%, no concept of 33.3%, and those who experience misconceptions in 2 questions, at 20%. Therefore, students are sure to understand the concept.

Problem number 3: Identify that the average student who understands the concept of soil degradation is a process that explains the phenomenon of decreasing soil capacity at present or in the future, in supporting human life which is influenced by human activities such as degradation, which causes a decrease in elemental concentration soil nutrient, amounting to 26.7%, no concept of 33.3%, and which experienced on two questions analyzed at 40%. Therefore, students are classified as poorly understood.

Problem number 4: Identify that the impact of erosion on the environment of the average student who understands the concept is 46.7%, no concept is 23.3%, and those who experience misconceptions in the two questions analyzed are 30%. Therefore, students are sure to understand the concept.

Problem number 5: Identify that students' understanding of the order of the average hydrological cycle of concepts is 40.0%, no concept is 43.3%, and those who experience misconceptions are 16.7%. Therefore, students are sure to understand the concept.

Problem number 6: Identify that students' understanding of tree indicators has an important role in the water cycle, namely absorbing rainfall and producing water vapour which will later be released into the atmosphere. So, the fewer the number of trees on the earth, then that means the water content in the air which will be returned to the ground in the form of rain is also small, the average understanding of the concept is 50.0%, no concept is 10.0%, and those who experience misconceptions amounting to 40.0%. Therefore, students are sure to understand the concept.

Problem number 7: Identify that students' understanding of the indicators disrupts water cycle damage due to landslides, the average concept of understanding is 36.7%, there is no concept of 13.3%, and those who experience misconceptions are 50.0%. Therefore, students are quite sure they understand the concept.

Problem number 8: Identify that students' understanding of the indicators causes disruption of water cycle damage due to landslides, the average understanding of the concept is 40.0%, no concept is 36.7%, and those who experience misconceptions are 23.3%. Therefore, students are quite sure they understand the concept.

Problem number 9: Identifying that the student's understanding of the indicators of landslide susceptibility parameters investigation requires daily rainfall data at the rain station in the watershed, the highest 3-day rainfall, which is chosen (mm/3 days) with data from the last ten years calculated from the average the point is, if you have> 1 station, the average understanding of the concept is 66.7%, there is no concept of 13.3%, and those who experience misconceptions are 20.0%. Therefore, students are sure to understand the concept.

Problem number 10: Identify that the student's understanding of the indicators of landslide susceptibility parameters investigation requires daily rainfall data at the rain station in the watershed, the highest 3-day rainfall, which is chosen (mm/3 days) with data from the last ten years calculated from the average the point is, if you have> 1 station, the average understanding of the concept is 90.0%, no concept is 10.0%, and those who experience misconceptions are 0.0%. Therefore, students classified as very confident understand the concept.

Problem number 11: Identifying students' understanding of the indicators of the development of the host rock type as a guideline in making the Geological map of the watershed, understanding the
concept of 13.3%, not having the concept of 30.0%, and experiencing misconceptions of 66.7%. Therefore, students are sure to understand the concept.

Problem number 12: Identify that students' understanding of the processed land indicators can pay attention to the identification of faults on the map, the average understanding of the concept is 30.0%, there is no concept of 30.0%, and those experiencing misconceptions of 40.0 %. Therefore, students are quite sure they understand the concept.

Problem number 13: Identify that students' understanding of indicators of large-scale use of water must be AMDAL and advised to use water in depressed aquifers, understand the concept of 43.3%, no concept of 26.7%, and who experience misconceptions amounting to 30.0%. Therefore, students are sure to understand the concept.

Problem number 14: Identifying students' understanding of indicators Land use for agriculture is limited due to evapotranspiration in earth and plant surface water for the needs of the active hydrological cycle because of the warmer tropical climate, average conceptual understanding of 13.3%, no concept of 30.0%, and those experiencing misconceptions of 66.7%. Therefore, students are sure to understand the concept.

Problem number 15: Identify that students' understanding of building permit indicators is according to the rules in each designation zone according to needs relating to the needs of many people, understanding the concept of 16.7%, not conceptual 33.3%, and experiencing misconceptions of 50.0 %. Therefore, students are classified as unsure about the concept.

4. Conclusion
Based on the results of data analysis that has been carried out on the conceptual understanding test of physical education students at Tadulako University on environmental physics in landslide material shows that the percentage of students who understand the concept is 37.33%, students do not understand the concept 32.22% and the percentage of students who still experience misconceptions is 30.44%. It shows that the conceptual misunderstanding and misunderstanding of the concepts experienced by students is still quite high, and the results show that students' understanding of concepts in the phenomenon of deforestation is still lacking.

4.1. Theoretical Suggestions
Research that takes samples from students is expected academically to provide theoretical contributions.

- The development of physics in the environmental filed in that face the various physical dynamics of landslides in our environment as a concrete manifestation of increasing national security is as one of the factors in efforts to improve national defence. Landslide disaster is a non-military threat that must be overcome by all Indonesia citizens, to achieve this goal it can be done by increasing the integration of physics knowledge in an integrated manner in dealing with disasters so that in the future there will automatically strengthen national defence.

- For the development of science, we must articulate environmental physics knowledge with human existence in the universe. It can be done by increasing science integrated into our lives, especially disaster caused by nature, such as landslides in areas with high potential for disaster.

4.2. Practical Suggestions
For higher education, it can synchronize curriculum, outcomes, and literacy (technology, humans, and the environment) in dealing with students facing natural disasters. Therefore, monitoring, socialization, seminars, cooperation involving the community and private companies and agencies/institutions are needed to jointly contribute to increasing awareness in behaviour so that a caring and alert attitude in the face of landslide disasters will increase welfare and security human.
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