Differences analysis understanding the concept of students between the three islands (Java, Kalimantan, Papua) through multiple representations approaches to the material of Time Dilation

I Kusumawati¹, M S Kahar², A Khoiri³ and A Mursidi⁴
¹Physics Education Department, STKIP Singkawang, Kalimantan Barat, Indonesia
²Mathematics Education Department, Universitas Muhammadiyah Sorong, Papua Barat, Indonesia
³Physics Education Department, Universitas Sains Al-Quran, Wonosobo, Jawa Tengah, Indonesia
⁴STKIP Singkawang, Kalimantan Barat, Indonesia

E-mail: intank@stkipsingkawang.ac.id

Abstract. The success of students in the achievement of learning if students have a concept of understanding and able to represent the concept it understands through various representation. This study aims to analyzing differences in understanding the concept of students between the three islands (Java, Kalimantan, Papua) through multiple representation approach on Time Dilation Material. Dilatation of time enters into part of the discussion of special relativity theories that require High Order Thinking and complex abstraction reasoning in understanding the concept. This research method is Quantitative with Comparative Hypothesis. The sample of this research is Physics Education students in Java, Kalimantan, and Papua. Sampling technique is Purposive Sampling. This research instrument is in the form of a description test that is completed in the form of Verbal (V), Diagram (D), Graph (G), and Mathematical (M) representations. Data processing is done by linking three aspects of conceptual understanding and four forms of representation in three different study samples. The results of this study indicate significant differences that occur in several variable opportunities with different scopes of research areas. This research is expected to be studied more deeply and sustainably.

1. Introduction
A multiple representation approach is an oriented to the understanding of concepts in the learning of physics, so that students in understanding the learning of physics need to improve the ability of representation, either in the form of verbal representation, diagrams, graphs, and mathematics [1]. Analysis of representation in this study was conducted without analysis of students' graphical representation capability because the ability of students' graph representation can be obtained through the problem that has certain specificity.

This multi-representation approach with various forms of representation has a part equivalent to the three aspects of conceptual understanding, arguing that multiple representations are divided into three multi-representation types used in problem-solving in conceptual comprehension is language/verbal representation skills, image/symbol representation, mathematical representation [2]. These three types of representations lead students to construct multi-representation of mathematical form to other multi-representation such as the form of mathematical representation in a table transformed into a form of
The material studied in this research is time dilation. This material is considered important to study because students have difficulty with this material. The success of a multi-representation-based learning, especially on the concepts of science and physics, is reported by various researchers, including for the development of science literacy, on the other hand, multi-representation capable of exploring the effectiveness of verbal representation, and other representations for students on the material [6]. In addition, this material is considered appropriate to examine students' conceptual understanding through multi-representation approach, with verbal representation form, diagrams, and mathematics.

The purpose of this study was to analyze the differences between students' understanding of the three islands (Java, Kalimantan, and Papua) through multi-representation approach. This research was conducted at universities from three islands in Indonesia, namely Java Island, Kalimantan, and Papua. Different geographical locations and different educational management and different cultural cultures provide an overview of the findings obtained, thus expected to have an impact on subsequent research.

2. Numerical Methods
This research uses descriptive quantitative research method. The sample in this study is the students who have followed the lecture with the material dilated time. The students who were sampled were from three different universities located in Java, Kalimantan, and Papua. The sampling technique is purposive sampling. In addition, the consideration in choosing samples in the form of universities from these three islands, namely selected universities are private universities in Indonesia, the culture and culture of the island occupied by different universities, as well as dilated learning time for each university using conventional methods. Students carry out learning about time dilation, at the end of the activity students are given multi-representation test questions. Student answer results are analyzed using an assessment rubric. This procedure is carried out the same in every college that is used as a place to collect research data. The instrument of this research is a matter of essay test containing three questions. Each of these test questions should be solved using verbal, diagrammatic and mathematical representations. The results were calculated using the percentage score formula with the following minor changes.

\[
\% \text{ Results Representation Score V/D/M} = \frac{\text{total score}}{\text{maximum score}} \times 100\%
\]  

(1)

This percentage calculation is applied to data obtained from research samples from three islands. The use of this formula can be done repeatedly for different representation form that is a representation of V, D, and M. After the result obtained is processed in tabulation and graph. Thus, it can be determined the difference in representational skills obtained in college students on the island of Java, Kalimantan, and Papua.

3. Results and Discussion
Based on Table 1, it is clear that the students' understanding of the concept of time dilation differs through representational approach. Most of the students' understanding of the concept is in the
problem-solving approach using mathematical representation in Java, Kalimantan, and Papua. This is because students have been accustomed to follow the learning in formal education with the approach of mathematical representation. The magnitude of the average percentage of students’ mathematical representation ability on the island of Borneo has a greater percentage than the other islands. This is because the students have become accustomed to the form of questions given. The difference in the percentage of mathematical representation capabilities in Kalimantan and Java is not much different. That is different to the understanding of student concepts in Papua. The percentage of mathematical representation capability found is still low, because students are rarely trained to perform problem-solving with the exposed systematics as indicators of the judgment of mathematical representation. Verbal representation and diagrams, understanding of student concept in Java island are better than Papua and Kalimantan island. But the island of Papua has a rival that competes with Borneo on the Verbal representation. This study results recapitulation of data obtained in this study is shown in Table 1 as follows.

Table 1. Multiple presentation Scores of University Students in Java, Kalimantan, and Papua

| Representation | % Multiple Representation Skill | Average |
|----------------|-------------------------------|---------|
|                | Java Island      | Kalimantan Island | Papua Island |       |
| Verbal         | 71.67            | 41.90           | 55           | 56.19 |
| Diagram        | 67.50            | 59.05           | 33.75        | 53.43 |
| Mathematics    | 84.17            | 86.67           | 70           | 80.28 |
| Average        | 74.45            | 62.54           | 52.92        |       |

The result of data obtained to determine the difference of understanding of student concept of three islands (Java, Kalimantan, and Papua) through the multi-representation approach on time dilation material can be seen in Figure 1 as follows.

Figure 1. Graphics understanding the concept of students between the three islands (Java, Kalimantan, Papua) through multiple representations approaches to the material of time dilation

Figure 1 shows has found that the percentage of students' verbal representation ability in Java Island was higher than that of Kalimantan and Papua; student diagram representation ability in Java Island is higher than Kalimantan Island and Papua; while the mathematical representation on the island of Borneo is higher than that of Java and Papua. This shows the difference in students' conceptual understanding can be determined through multi-representation approach. The average percentage with
the sequence of students' conceptual understanding through multi-representation approach from high to low percentage students from Java, Kalimantan, and Papua. Differences in conceptual understanding can occur through two trends developed from recent studies this is how students use different representations when solving problems and how different representational formats affect students' performance in problem-solving, other than that the use of good representation can support the successful mastery of the student concept itself [7]. The multi-representation learning process provides an opportunity for the formation of meaning in the way memory works so that students are able to link between words and images simultaneously and simultaneously, in addition to providing a diverse model or format of representation will indicate the probability of conceptualization and how to communicate the problem [8].

4. Conclusion
The conclusion of this research is that the students of Java Island have a conceptual understanding of the multi-representation approach which is higher than the students on Kalimantan Island and Papua Island.

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