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Concept Mastery of Physical Education Students In Multiple Representation (MR) Based Three Dimensional Solid Object Motion Mechanics (3DSOM)

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Abstract. Physics is a part of sciences which is most explain about nature and its phenomenon starting from anything real until anything abstract. One of the material in mechanism lecture which is considered as difficult and abstract is material of three dimensional solid object motion (3DSOM). This research aims to find out the concept mastery of 3DSOM in mechanics learning to physical education students. The subject of this research are students of 3rd semester amounted 21 people in one LPTK. The instrument used in this research is mechanics concept module of multiple representation (MR) based 3DSOM to measure the concept mastery of 3DSOM and test essay of MR based 3DSOM mastery concept which is compatible with indicator of concept understanding using Bloom's Taxonomy Revised. This research uses quantitative and qualitative descriptive method to find out the achievement of concept mastery towards multiple representation based 3DSOM. The results of this research found that the average MR-based concept module percentage of material GBT3D 50.9% verbal, 63.6% pictures, 43.0% graphics and 72.2% mathematics which the four MR categories showed a pretty good percentage. The mean results for the pretest value of 37.4% and the average posttest value of 76.1% with the percentage of N-Gain 61.8% for the mastery of the concept of 3DSOM showed an increase. Limitation in this research is only involves one class with less number of students from one university, so that the result is not strong enough to represent the whole situation, this can becomes manner to conduct further research with larger amount of samples and different mechanics content. This research is the first which analyzes the concept understanding towards MR based 3DSOM mechanics lecture material content by analyzing the verbal, picture, figure, and mathematics skills.

1. Introduction

Mastery of the concept of physics in learning is the ability of a person to develop one fact with another fact. Physics is a branch of science that studies something concrete and can be proven mathematically using equation formulas that are supported by research that is continually being developed by physicists [1]. In mastering a physics concept if the concept is true it must be able to explain in its own words which is in accordance with the knowledge possessed. Mastery of concepts is very important for students because this is an indicator that students have fully understood what they have



learned, so that later mastery of these concepts can help students in solving problems not only in lectures, but also in teaching practice in schools. Using multiple representations is a fundamental process in mastering a concept [2]. Material of mechanics in concept of three dimensional solid object motion (3DSOM), includes sub concepts of solid object motion in 3 dimensions: Moment of inertia, angular momentum and kinetic energy, Axis center axis, Euler Equation in Solid Motion, Free Rotation of Solid objects: Description of Geometric Motion, Free Rotation of Solid objects with Symmetrical Axis, Description Rotation of solid object relative to the Coordinate System, Eulerian Angle, Motion of Torque, Equation and Energy Increase, Gyrocompass, Why Lance does not Fall Over (Mostly) [3]. Formulating concept or principles in the three dimensional solid object motion.

Multiple representation is a teaching practice which involves depictions, symbolizes, or represents a concept or process through different forms of representation [4]. Learning style is a manner for students to understand information, for example there are students who find it easier to absorb by verbal learning, but there are students who are easier with drawing or mathematical learning [5]. Facing that learning skill needs a learning approach that can deliver material in multiple representation way [6]. Learning style can be categorized as three types of style which are visual, auditorial and kinesthetic [7]. From these three learning styles there are individuals who tend to one style, and there are also those who tend to all learning styles [8]. If the teaching strategy of teacher is similar to student learning styles, then there is no lesson that is difficult [9]. Multiple representation and multimedia can support learning in many different manners [10]. Learning with multiple representation is more effective in building mental model of student and understand the concept compared to conventional learning [11].

2. Methods

This research was conducted in Private University in Jakarta, started from December 2018 until January 2019. This research used quantitative and qualitative descriptive method to find out the achievement of multiple representation based 3DSOM mechanics concept mastery. The instrument used in this research is mechanics concept module of multiple representation (MR) based 3DSOM concept understanding to measure the understanding towards concept of 3DSOM and essay of MR based 3DSOM mastery concept which in accordance with concept understanding using Bloom's Taxonomy Revised [12]. The subject of this research are students of 3rd semester academic year of 2018/2019. The total of students involved were 21. The data analysis technique in this research was conducted with analysis of N-Gain, normality, homogeneity, and t test [13].

3. Results and Discussion

The most important process in learning physics continuity is to understand the basic concepts in physics [14]. The data collected in this study are in the form of understanding the concept of mechanics in 3DSOM material obtained from MR-based content modules and the results of student pretest and posttest after the application of multi representation 3DSOM material learning mechanics in the material of three dimensional solid object motion (3DSOM).

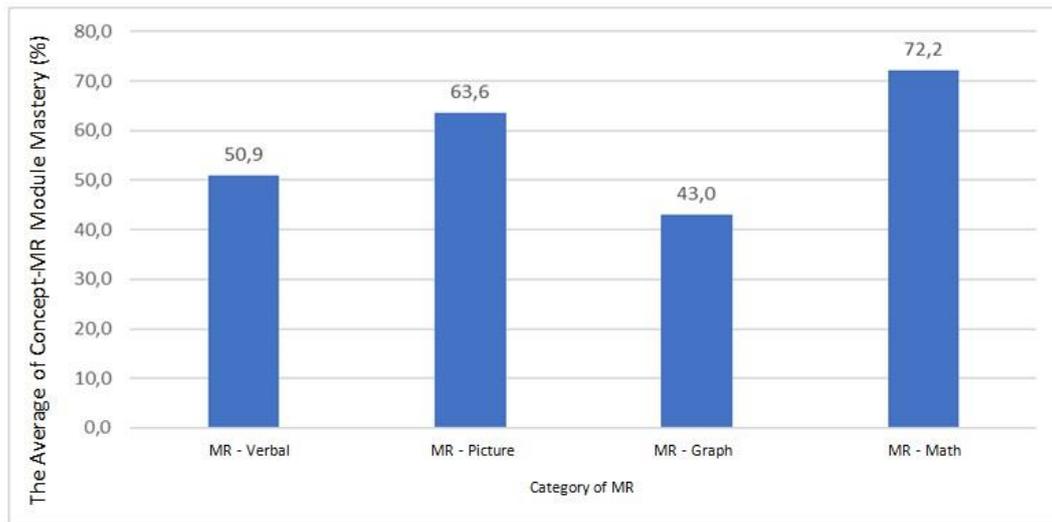


Figure 1. The average of concept mastery in MR based module in 3DSOM

In the figure 1. the analysis result of multiple representation (MR) in module material of 3DSOM is; for understanding verbal concepts 50.9%, 63.6% pictures, 43% graphics and 72.2% mathematics. Of the four multiple representations, the percentage results obtained in the range values off 43% to 72% with quite good category, this because the lack of students ability to analyze verbally and graphically in three-dimensional material on the central axis of solid objects. Overall and according to the indicators for each sub-chapter there has been a change and improvement in understanding the concepts in 3DSOM .

Pretest and posttest were given to find out the success level of treatment in experimental class, with multiple representation basis can improve the student concept understanding in material of 3DSOM Figure 2 Analyze the mean of pretest-posttest and N-gain of MR based three dimensional solid objects motion (3DSOM).

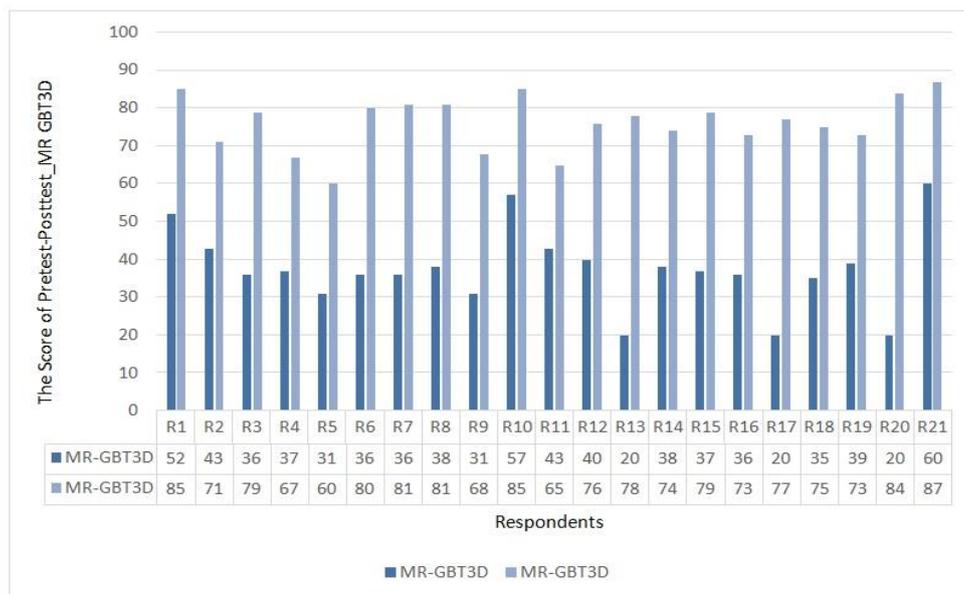


Figure 2. The average of Pretest-Posttest and N-Gain of MR based Three Dimensional Solid Objects Motion (3DSOM)

In figure 2. The analysis results in this research showed that the pretest mean value was 37.4% and the posttest mean value was 76.1% with an N-Gain percentage of 61.8% for the mastery of the 3DSOM concept showing an increase. Consisting of 5 students 23.8% in the medium category, 13 students 61.9% in the high category and 3 students 14.35% in the very high category. From the posttest results it was concluded that the mastery of the concepts of physics education students in the learning of three-dimensional solid object motion mechanics based on multiple representations increased.

4. Conclusion

The results of data analysis and discussion of understanding the basic concepts of mechanics in students of third semester found that learning mechanics with a multiple representation (MR) based 3DSOM material module on the mastery of concepts in physics education students showed an increase in mastery of concepts with a fairly good percentage. Then learning about mechanics based on multiple representations can be implemented for the material of 3DSOM. Based on the conclusions from the results of the research, the authors suggest that the application of learning mechanics based on multiple representations can be used as an alternative learning approach on other material based on concept planting and it is hoped that other researchers can provide a variety of mechanics based learning approaches with more varied representations. the findings on the results of the pretest posttest 3DSOM achieved results in the high category. But for researchers in the future, if you want to develop this research more broadly, you can develop it by reviewing student learning styles in a wider group so that data retrieval is not only limited and the accuracy level and data strength can be higher.

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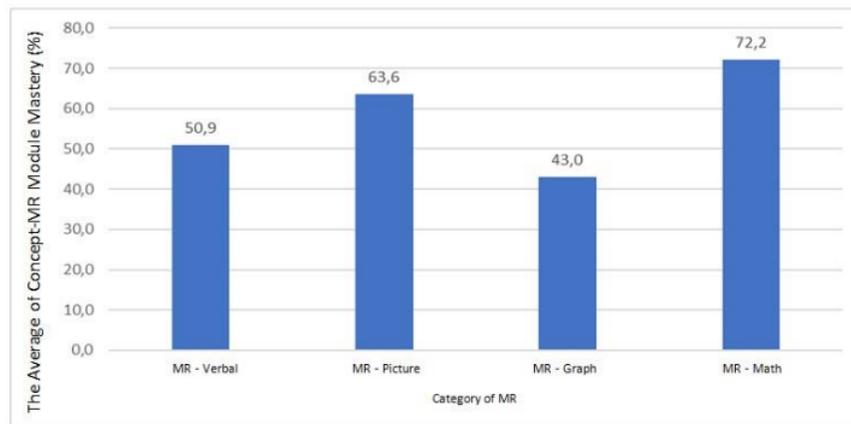


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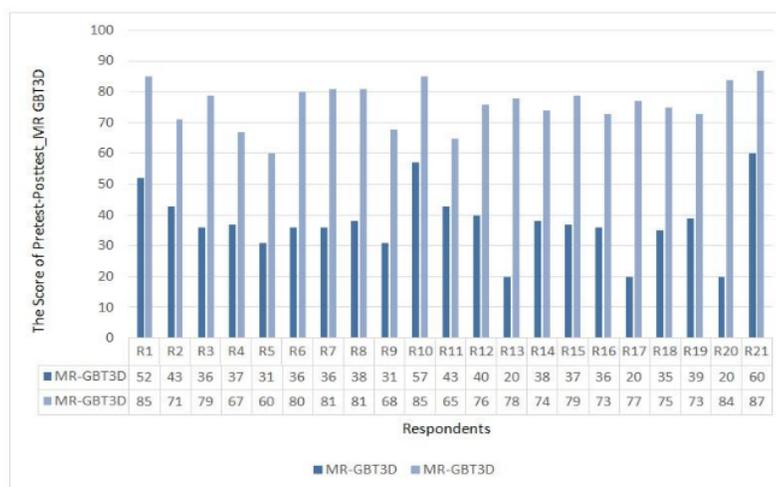


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