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CHARACTERISTICS OF MULTIPLE REPRESENTATIONS-BASED MECHANICS LEARNING (PPMB-MR)

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Abstract

This research aims to develop the student 's ability to build a representation of the basic concepts of mechanics . this using a mixed method design to combine the qualitative and quantitative research procedures in a study to solve a problem . Qualitative data were collected through questionnaires, interviews and document analysis, while quantitative data using the test. Characteristics of PPMB-MR is consists of seven phases of learning characterized by phases of learning that provide space on a student to take a greater role in the learning process . Increased student mastery of the concepts of mechanics a shift from mere rote (narrow -level) to a level of mastery of the deep (deep level) . Students can use the representation to argue scientifically . The response of the students and lecturer are very positive program. Their sincerity, motivation, awareness and confidence to attend lectures more better.

Key words: multiple representation, mechanics, mastery concept

INTRODUCTION

Physics is the branch of science which focuses on physical form of natural phenomena. Scientists construct concepts and theories to explain that phenomenon. In physics, conceptual knowledge often formed in abstract symbols which difficult to understand, so that the student afraid. The difficulties in understand the abstract symbol appears because the human mind was not able to give the best response to the abstract representation.

According to cognitive psychology view, human mind tend to match any new experience with previous events, and generally symbols in physics are not "the previous events", so that's why learner have difficulties of it. But the most important is how teacher tried to create smooth transition to adjust their mind with learner mind through *multiple exposures*. Therefore, the productive strategy in teaching is provide a variety of representations of a physical process, such as words, pictures or sketches, diagrams, graphs, and mathematical equations. In learning, description of a concept of sciences will be more explicit when these concepts are presented using a variety of representation at once.

Etkina, et.al (2006) though that skills in represents concepts is scientific competencies that must be well-mastered by the teacher. These competencies including the skill in represent an information in a variety of ways. Even McDermot (1990) stated that ability of represents is a basic ability which need to be developed through the physics learning. Schmidt, Leland, & Richard (2011) considers that prospective teacher preparation programs must be able to create prospective teacher whom competence is highest as possible. The competence of multiple representation are need to develop the professional competence autonomously and incessantly.

In lecture of Physics Education of FKIP in Sriwijaya University, mechanics are a subjects which must be taken by the students. Mechanics studied the close relationship between force, material,

and motion with a wide scope from small objects until very large size objects. Many studies have reported that mechanics concepts are very difficult to be understood by students, both at the undergraduate, master and doctoral programs as reported by Shaffer and McDermot (2005).

Thus, the mechanics subject need to have special attention. Many researchers who recently started paying attention to learning the subject matter of mechanics, as did Sadaghiani (2012) and Waldrip, et al. (2012). For this time being science education research also recommend that to learn science effectively, learners need to understand a wide variety of ways to represent the concepts of science (Huber , Tytler , & Haslam, 2010; Prain, Tytler, & Peterson, 2009). This paper will explain the characteristics of multiple representation (PPMB-MR) based mechanics subject program that can develop students' ability in constructing representations of the basic concepts of mechanics.

RESEARCH METHODS

This research is development research using Mixed Methods Research design through embedded experimental models as in Figure 1. Subjects of this research were students of the third semester of physics' prospective teacher of S1 Physics Education, Study Program of Sriwijaya University who takes Mechanics subject. Instrument were used of this research is expert validation sheet of developed PPMB-MR, and questionnaire containing responses of lecturer / student which used to collect the response and suggestions from lecturer/students of the program developed.

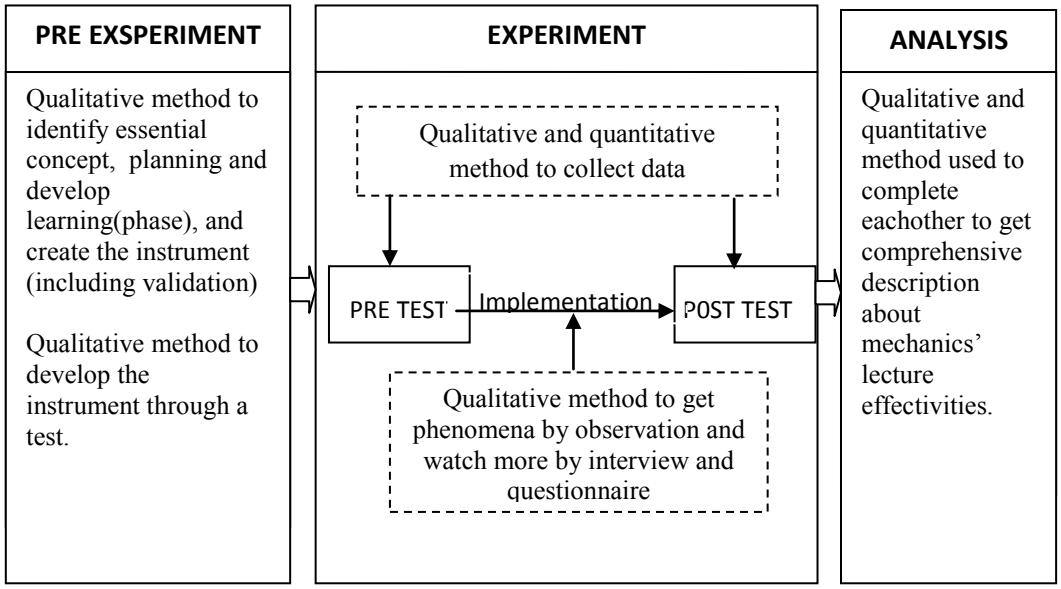

Figure 1. Study design using mixed methods research through embedded experimental model (adapted from Creswell & Clark , 2007).

RESULTS AND DISCUSSION

The initial design of multiple representations based learning refers to the framework - SO IF (IF - SO framework) proposed Waldrip, et al. (2010). IF-SO framework design, starting with the identification of key concepts (Identify), focus on the format and function of a concept representation (Focus), pay attention to the order of the activities of students in constructing concepts (Sequence),

and the development of simultaneous assessment of learning (Ongoing assessment). Furthermore, the framework is formulated in the form of syntax or sequence of learning steps. Initial syntax formulated consists of 6 phases of learning, namely; Phase presenting phenomena, phase identification of key concepts, concept exploration phase, construction phase representation, internalization and consolidation phases of concept, and evaluation phases.

PPMB- MR based syntax above, the initial design is translated into the syllabus and developed a step by step to the Lesson Plan. Preparation of syllabus and lesson plans intended to meet the standards set by the lecture colleges and will serve as the basis and reference for the study.

Lecture program that has been formed , then performed limited testing on prospective students of the fifth semester physics teacher academic year 2012/2013 on one LPTK in South Sumatra Province. The trial program conducted to get a response from faculty and students on the implementation PPMB - MR . The results of the assessment program faculty observer is very positive, however, faculty observers suggest that there is a phase of learning that provides students the opportunity to improve its representation (re - represent) based on the input in the evaluation phase. Syntax early learning PPMB - MR models developed again and translated into 7 phases as shown in Figure 2.

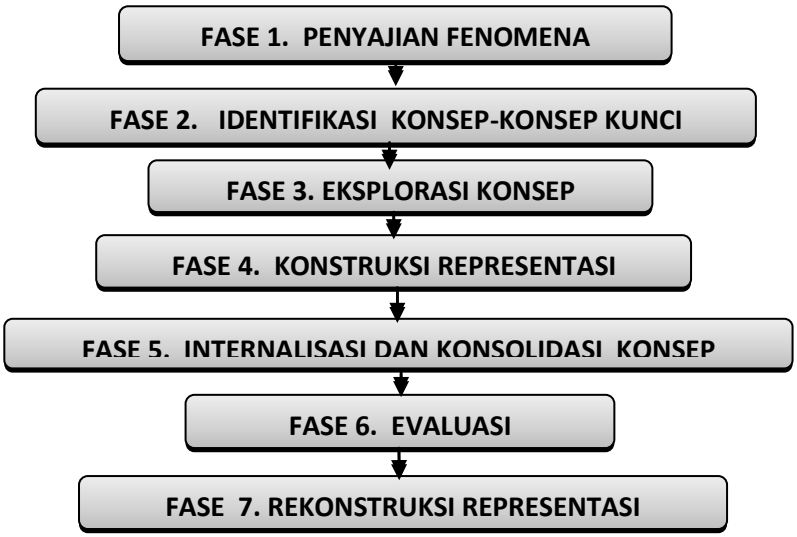

Figure 2. Syntax of PPMB–MR

Multiple Representations-Based Mechanics Learning (PPMB-MR) many students develop the ability to construct a variety of representations to represent the concepts of physics. In the learning, representation of the most frequently and commonly used by teachers are mathematical representations and verbal representations, so that the representations are often overlooked in other formats. The fact is in line with research conducted Ismet, et al. (2012) that the quality of the representation of mathematical and verbal representation of most of the students have been in the category of very good and excellent.

In the implementation phase of the program, initially found that the ability of students to build a representation of one form of representation to another representation format has not been consistent (Ismet et al., 2013). Students must learn to make the representations as well as representations in other formats.

PPMB-MR developed greatly assist students in developing the ability to build representations . Syntax - existing syntax can anticipate weaknesses against the constructed representation . There is a phase internalization and consolidation concepts that appear after the student menkonstruksi concept . This phase helps students to strengthen, sharpen and deepen their understanding of a concept, because representations have complementary functions , and a single representation is not enough to present a complete explanation of a concept (Ainsworth , 2006). Students develop the ability to perform tranlasi representation concepts from one format to another format representatio . While the evaluation phase is very useful to evaluate and review the student 's work, and at the end there is a useful representation of the reconstruction phase to provide opportunities for students to improve and refine the representation constructed.

Increased consistency and competency of students in constructing representations of concepts from time to time also have an impact on increasing student mastery of the concepts represented . Student mastery of the concept shifted from simply memorizing (narrow -level) to a level of mastery of the deep (deep level) , and students are also able to construct an argument using representations that they wake up.

Characteristics of learning mechanics based representation characterized by the presence of multiple phases of learning that provide space on a student to take on a role that is very much in the activity of building a representation , representation communicate, evaluate and ends with a re - representation of the concept phase. The steps or syntax in PPMB - MR is very important to equip students as prospective teachers , so that in time they became teachers , students already have a model that can be used as a reference in managing learning.

CONCLUSION

From the research it can be concluded that : (1) the characteristics of the MR has a syntax PPMB - learning consists of 7 phases of the learning phase : the presentation of the phenomenon , identify key concepts , concept exploration , construction phase representation, internalization and consolidation of concepts, evaluation, and a the re-represents. PPMB-MR characterized by phases of learning that provide space on a student to take a greater role in the learning process . (2) Program mechanics lecture -based multiple representations can enrich students build diverse pengamalam representasai physical concepts and can have an impact on improving student mastery of the concept than just rote (narrow -level) to deep level.

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