EFFECTIVENESS OF RESEARCH-BASED INSTRUCTIONAL STRATEGY COMPARED TO CONVENTIONAL METHOD IN TEACHING AND LEARNING OF MECHANICS

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Dedicated to my family, friends, lecturers and to people

helping me with this research

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ABSTRACT

Conceptual knowledge is a crucial part in learning Physics. Students often being taught in a traditional lecture-based class and their knowledge in the concept of physics usually based solely on the students' performance in the final exams. This research is done to determine the students' conceptual knowledge in Mechanics subject. This research was done by conducting two tests which was adapted from the use of Force Concept Inventory (FCI). The students were divided into two groups with different teaching method, one with traditional lecture-based class and the other using Research-Based Instructional Strategy (RBIS) method. The data obtained from students' performance in the test was collected and analyzed. Based on the research, it was proven that the students had little conceptual knowledge in Mechanics. The value of normalized gain, g obtained between the two groups were 0.206 for lecture-based class and 0.318 for RBIS class. Based on the t-test conducted, the difference of gain between these two classes was not significant. Among all the 30 questions from the test, it is proven that the students still had misconceptions on all the conceptual questions posed in the test.

ABSTRAK

Pengetahuan konsep adalah bahagian penting dalam pembelajaran Fizik. Pelajar sering diajar dalam kelas berasaskan kuliah tradisional dan pengetahuan mereka dalam konsep fizik biasanya hanya berdasarkan kepada prestasi pelajar dalam peperiksaan akhir. Kajian ini dijalankan bagi mengetahui tahap pengetahuan konsep asas pelajar terhadap subjek Mekanik. Kajian ini telah dilakukan dengan menjalankan dua ujian yang telah diadaptasi melalui penggunaan Inventori Konsep Daya (FCI). pelajar dibahagikan kepada dua kumpulan, iaitu yang menggunakan pembelajaran secara tradisional melalui kuliah dan kumpulan yang menggunakan kaedah Strategi Pengajaran Berasaskan Penyelidikan (RBIS). data yang diperoleh melalui keputusan ujian pelajar dikumpulkan dan dianalisa. Melalui kajian ini, telah dibuktikan bahawa pelajar mempunyai tahap kefahaman konsep yang rendah dalam subjek Mekanik. Nilai faktor penambahan normal, g yang diperoleh antara dua kumpulan adalah 0.206 melalui pengajaran konvensional dan 0.318 melalui pengajaran RBIS. Menerusi ujian t yang dijalankan, nilai perbezaan antara dua kumpulan ini adalah tidak signifikan. Daripada 30 soalan yang terdapat dalam ujian yang dijalankan menunjukkan bahawa pelajar masih mempunyai salah konsep daripada kesemua soalan konsep yang diajukan.

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RBIS	-	Research-Based Instructional Strategies
JiTT	-	Just-in-time teaching

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CHAPTER 1

INTRODUCTION

1.1 Research Background

Many physics education research (PER) that has been done over the years revealed a shocking fact that the students learned very little of conceptual knowledge in physics. Physics generally is a very hard subject to be mastered without understanding its basic conceptual knowledge. Crouch and Mazur (2001) stated that it has been proven students learning through conventional teaching method usually understand very little of the concepts. They normally memorized the facts that has been delivered through the lectures and hardly can relate to concepts with real life situations.

The students usually have their own basic ideas on how the physical systems behave even before they start to study physics. This idea which is usually referred as alternative conceptions or common sense science in most of the cases are different

from the accepted scientific ideas (Maloney, et al, 2001). Hence this research is conducted in order to know the students' level of understanding in conceptual Physics before and after attending the courses.

In order to achieve the objectives of this research, different teaching method will be applied to two groups of undergraduate students. They have taken Mechanics subject, which is a compulsory subject during their first year of study. The teaching methods applied is the conventional (traditional) teaching method for one group while the other using an active learning method based on Research Based Instructional Strategy (RBIS). The conventional teaching method includes the learning process through the lectures and tutorials in class while the active teaching method is the interactive learning, through several combinations of teaching method.

1.2 Problem Statement

It is said that studying through the traditional teaching method does not really improve the students' understanding towards the basic conceptual knowledge in physics. This is also added by the misconceptions that the students had before attending the classes. In the end, the misconceptions that the students have does not being corrected but simply being replaced by memorizing the facts that they learned throughout the lecture sessions and gets more confusing for the students to actually understand the real concepts involved.

Hence, this research aims to determine the students' level of understanding towards conceptual physics in Mechanics subject and to determine the best learning method that should be applied to the students in helping them to understand the concepts more effectively.

1.3 Objectives

1. To determine the level of understanding on conceptual knowledge in mechanics among new physics students.

2. To compare the performance of the students based on the different teaching method applied to the students.

3. To determine the topics in which proven difficult for the students to understand with the misconceptions that they had.

1.4 Scopes of Research

The purpose for this research is to determine the level of the conceptual knowledge that the students had in the concept of the fundamental physics in mechanics subject. The process involved the construction of the "mock" Force Inventory Concept (FCI) test to be used as the instrument to measure the students' conceptual knowledge. Next, the data and information on different teaching method

from Research Based Instructional Strategy (RBIS) are collected. These methods were used to compare the students' performance by using different teaching method in class. The results for this research were determined based on the students' performance in both of the test before and after the lectures for the semester.

1.5 Significance of Study

Throughout this research, we can understand better on the students' level of basic conceptual physics knowledge in Mechanics. The first pretest that has been done in the early of the semester will enable us to know exactly their level of understanding in the basic concepts before attending the classes. This helps us to know the basic concept that they understand throughout their previous learning process before entering the university level. It gives us the information on the topics that is difficult to the students that leads to the misconceptions.

By applying different teaching methods on these two groups, we can determine the effectiveness of the teaching method used in boosting and enhancing the students' knowledge on the real concepts in mechanics. This is based on the results from the post test that will be conducted by the end of the semester, after the students had learned in all of the classes throughout the semester. Based on their performance we can determine whether different teaching method do affect their understanding in the basic concepts.

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