STUDENTS' PERCEPTION AND PROBLEM SOLVING SKILLS IN LEARNING PHYSICS THROUGH PROJECT – BASED LEARNING (EGG DROP PROJECT)

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FACULTY OF SCIENCE AND NATURAL RESOURCES
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I hereby declare that the material in this thesis is my own except for quotations, excerpts, equations, summaries and reference, which have been duly acknowledge.

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ABSTRACT

This study was attempted by the researcher to examine students' personal interest, sense making and effort, real world connection and problem solving with the implementation of Project-Based Learning (PBL) – egg drop project towards learning physics in three (3) different perspectives which were overall students, gender (i.e., male and female students) and location (i.e., urban and rural students). Students have done egg drop project to have better understanding towards physics concepts (i.e., momentum, impulse and impulsive force).This research was taken place in one selected school at Tuaran (i.e., 20 urban students) and Kota Marudu (i.e., 18 rural students) Districts and was carried out on thirty-eight (38) Form Four students (i.e., 17 male and 21 female students) for both school in total. Data from this study were collected quantitatively and qualitatively. Quantitative data were collected via The Colorado Learning Attitude about Science Survey (CLASS) – personal interest, sense making and effort, real world connection and problem solving general category before and after PBL. Gathered data were analysed using Statistical Package for Social Science Version 20.0 for windows (SPSS) to compare the students' pre-survey and post-survey responses by using Wilcoxon Signed Ranks Tests. Wilcoxon Signed Ranks Tests results showed that students in each perspective have statistically significant difference after PBL for each CLASS - category except rural students' personal interest have no significant difference after PBL. Spearman's Rank – Order Correlation showed that students in each perspectives have significant positive correlation in each CLASS-category post-survey. In additon, quantitative data from focus group interview and focus group discussions showed emergence themes were fell under personal interest, sense making and effort, real world connection and problem solving perception category after trancriptions have been done. Robust assessments of students' problem solving skills showed that students in each perspective were more expert like in solving physics problems during PBL – egg drop project. Spearman's Rank – Order Correlation showed that students in each perspective have significant positive correlation in each CLASS category with their problem solving skills. Through PBL – egg drop project, students can relate physics concepts; momentum, impulse and impulsive force into real life situations, engage students' personal interest, increase students' sense making and effort, have problem solving confident and change students' perception towards learning physics.

ABSTRAK

PERSEPSI PELAJAR DAN KEMAHIRAN MENYELESAIKAN MASALAH DALAM PEMBELAJARAN FIZIK MELALUI PEMBELAJARAN BERASASKAN PROJEK – PROJEK EGG DROP

Kajian ini adalah usaha penyelidik untuk menguji minat peribadi, keupayaan untuk membuat pertimbangan dan usaha, perkaitan dengan dunia sebenar dan penyelesaian masalah para pelajar melalui pelaksanaan Pembelajaran Berasaskan Projek (PBL)– Projek "Egg drop" terhadap pembelajaran fizik dalam tiga perspektif yang berbeza iaitu keseluruhan pelajar, jantina (i.e., pelajar lelaki dan perempuan) dan lokasi (i.e., pelajar bandar dan luar bandar). Para pelajar telah menjalankan projek "egg drop" untuk pemahaman yang lebih mendalam terhadap konsep fizik (i.e., momentum, impuls dan daya impuls). Kajian ini telah dijalankan di salah sebuah sekolah di Daerah Tuaran (i.e., 20 pelajar bandar) dan Kota Marudu (i.e., 18 pelajar luar bandar). Kajian ini telah dijalankan ke atas seramai tiga puluh lapan (38) pelajar Tingkatan Empat (i.e., 17 pelajar lelaki dan 21 pelajar perempuan) untuk kedua – dua buah sekolah. Data daripada kajian ini dikutip secara kuantitatif dan kualitatif. Data kuantitatif dikutip melalui "The Colorado Learning Attitude about Science Survey (CLASS)" – kategori minat peribadi, keupayaan untuk membuat pertimbangan dan usaha, perkaitan dengan dunia sebenar dan penyelesaian masalah umum sebelum dan selepas PBL. Data terkumpul dianalisis melalui "Statistical Package for Social Science Versi" 20.0 untuk "windows (SPSS)" untuk membandingkan respon para pelajar terhadap soal selidik pra dan soal selidik pasca menggunakan Ujian "Wilcoxon Signed Ranks" . Keputusan dalam Ujian "Wilcoxon Signed Ranks" menunjukkan pelajar dalam setiap perspektif mempunyai perbezaan statistikal yang signifikan kecuali pelajar luar bandar tiada perbezaan yang signifikan untuk setiap kategori dalam CLASS selepas PBL. Daripada korelasi "Spearman's Rank – Order" menunjukkan korelasi positif yang signifikan melalui soal selidik pasca bagi setiap kategori dalam CLASS. Data kualitatif juga menunjukkan terdapat tema yang muncul semasa temuramah kumpulan berfokus dan perbincangan kumpulan berfokus yang jatuh kepada kategori minat peribadi, keupayaan untuk membuat pertimbangan dan usaha, perkaitan dengan dunia sebenar dan persepsi penyelesaian masalah para pelajar. Penilaian teguh terhadap kemahiran para pelajar untuk menyelesaikan masalah fizik semasa projek "egg drop" menunjukkan pelajar dalam setiap perspektif adalah seperti pakar. Korelasi "Spearman's Rank – Order" juga menunjukkan korelasi positif yang signifikan bagi setiap kategori dalam CLASS dengan kemahiran pelajar untuk menyelesaikan masalah. Melalui, Pembelajaran Berasaskan Projek – Projek "Egg drop", para pelajar dapat mengaitkan konsep fizik; momentum, impuls dan daya impuls pada situasi kehidupan yang sebenar, membentuk minat peribadi, meningkatkan keupayaan membuat pertimbangan dan usaha, keyakinan untuk menyelesaikan masalah serta menukar persepsi para pelajar untuk mempelajari fizik.

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CHAPTER 1

INTRODUCTION

1.1 Introduction to the study

Malaysian Government has spent millions of ringgit to improve the education system in the country but apparently number of students who passed in Sijil Pelajaran Malaysia (SPM) examination was decreasing each year (Nunis, 2015). In addition, Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA) results shows that Malaysian students are lacking with higher order thinking skills and ranked behind neighbouring countries such as Thailand and Singapore that increased public scrutiny and debate (Ministry of Education Malaysia, 2012). Moreover, criticism about Malaysian education system that is too examination - based oriented and emphasis on rote learning that leads students have an idea to study all subjects in school just for the sake of examinations (Chuo, 2007). The Malaysian Education Blueprint (2013 – 2025) is a new policy launched by the Ministry of Education Malaysia in providing long term improvements towards education system in Malaysia priorities to equip students with the 21st century learning style to produce students with knowledge and skills at the international benchmarks (Ministry of Education Malaysia, 2012).

In Malaysia, physics subject taught at the beginning of Form 4 in secondary school. This is to get along with the National Education Philosophy to give fully understanding to the students regarding subjects that had been taught in school to generate a knowledgeable community in the country (Norihan, Hamzah and Udin, 2011). But students who pursue physics in Malaysian secondary school level are still far behind where most schools provide approximately 40% science students and 60% arts students (Salmiza, 2014). This happens because physics' popularity is not so high among secondary and high school's students (Holubova, 2008). Many students who enrolled in physics related course think and say, physics is difficult to learn and understand (Angell, Guttersrud, Henriksen and Isnes, 2004). Female students feel discouraged to learn physics because they find it difficult and men do better in physics which they rather to learn chemistry instead (Cervini, 2014). Meanwhile, in general, rural students are left behind in terms of academic achievements as well as lower educational aspirations in comparison with urban students (Salmiza, 2014).

The obvious factor makes physics difficult on the students' view are physics irrelevant to learn with the connection of everyday life and the more students learn about physics the more boring they will get (Erinosho, 2013). This perception leads on a negative attitude towards physics. If students will not have a clear view what they learn and absorb, it will lead them to view physics as jumble of formulas and unrelated facts to memorise (Qian and Alvermann, 2000). Since physics involves a lot of representations includes experiments, graphs, formulas and calculations as well as conceptual explanations (Ornek, Robinson and Haugan, 2008). This problem leads to a point where students feel that to learn physics is beyond their ability and capabilities to comprehend (Kovanen, 2011). At the same time, teachers have an impression over the period of time learning physics, students may lose or fail to gain an enthusiasm for physics (Williams, Stanisstreet, Spall, Boyes and Dickson, 2003). Students' perception about physics will determine their understanding and learning process with physics. Therefore, in this study, an alternative approach has been used to change students' perception and problem solving skills to be more positive when learning physics.

1.2 Background of the Problem

Traditional approach in teaching physics has been used for a long time not just in secondary school level but as well as university level (Wang, 2005). Traditional approach involves teacher-centred learning method where students just sit; look the teacher explains and solves associated problems in front and students just passively absorb information what they hear and see (Liu, 2014). To see the effectiveness of traditional approach, students have to sit for examinations to measure on how well they have understand from what they have learnt (Wang, 2005).

Traditional approach in teaching physics often leads students hard to connect with what they have learnt in class with the real life situations (Wang, 2005). Students think that physics irrelevant to learn with the connection of everyday life and the more students learn about physics the more boring they will get (Erinosho, 2013). By over emphasis on examination results, students are further pressured by schools, parents and peers to score academically and students fail to develop their soft skills such as problem solving skills which students spend most of their time to attend extra classes, tuition classes and examination workshops to excel themselves in examinations (Sarina and Tengku, 2014).

Students' interest in physics needs to be sharpened and nurtured from early stage (Ornek *et al.*, 2008). Students' interest and their effort are related to each other, when students have an interest towards physics, students' effort followed to learn more about physics (Net Industries, 2016). Meanwhile, students' interest also influences their abilities to solve problems (Khoo, 2015). Students have a meaningful learning towards physics when the problem solving strategy is involved real world connection problems (Bernkert, 2005). In solving physics problems, knowledge and skills are related to each other to maintain a positive attitude towards physics (Erdemir, 2009). To be an expert problem solver, individual should turn problem solving into a habit which individual gain more experience and knowledge to feel more empowered when future problems arise (Allen, 2014).

Students should be taught the problem solving method to make them fully understand the meaning of given questions and able to relate with their existing knowledge (Erdemir, 2009). Teacher needs to take control on how the students think about physics, teacher's role is to inspire and help students to understand the physics concept with various of teaching strategies (Subramaniam, 2009). When students come to the course with more personal interest, real world connection, sense making and effort are likely to have higher learning gain (Perkins, Gratny, Adams, Finkelstein and Wieman, 2006). Furthermore, male and female students' desire to learn increase when teachers provide them with teaching that involved real world applications and connection to careers (Lock, Castillo, Hazari and Potvin, 2015). Meanwhile, in general, rural students are left behind in terms of academic achievements as well as lower educational aspirations in comparison with urban students (Salmiza, 2014). Hands on activities for physics in everyday life course give a positive effect towards students' personal interest, sense making and effort, real world connection and problem solving (Harlow, Landau and Bailey, 2013).

Hands-on projects such as egg drop project helps students to have better understanding in physics where students work in teams (Sridhara, 2013). Active learning can be obtained from an egg drop project which students define problems correctly and making reasonable working solutions that trigger problem solving skills, interest and their sense making and effort (Kasunic, Bagnell, D'Archangel, Dillard, Douglass, Mills, Ott, Relina and Webb, 2012). Team building and scientific exercises can be established by the great egg drop challenge which encourages students to identify the problem, formulate a hypothesis, design an experiment to test the hypothesis and perform the experiment as well as to evaluate whether the egg survives during the experiment (McDonald and Robinson, 2014). In addition, egg drop project helps students to build their manipulative and scientific skills to relate physics concepts with the real life situations as well as to increase students' interest to discover more about physics (Yusfi, 2014).

To change students' perception and problem solving skills towards physics into more positive and enjoy learning, new pedagogical strategies need to be adopted beyond the traditional approach to improve the learning outcomes. Because of this, researcher comes forward by introducing Project Based Learning (PBL) – egg drop project to improve students' personal interest, sense making and effort, real world connection and problem solving towards learning physics as well as to investigate the correlation between them after intervention.

1.3 Problem Statements

Students' enrollments in physics at secondary school find physics is difficult and boring (Angell *et al.*, 2004). Meanwhile, female students preferred to learn