Developing concept of a frictional force by using predict-observe-explain (POE)

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ABSTRACT

We have learned from our experience of teaching physics that students misunderstand about the concept of a frictional force. The objective of this work is to enhance the students' understanding on the concept of a frictional force for grade 10 students of Chaiyaphumbhakdeechumphon school, Chaiyaphum province. The research tools consist of the teaching plan with predict-observe-explain (POE) technique, experiment sets, and conceptual tests on the frictional force. The result showed that the average posttest score was higher than that of pretest with statistical significance of .05. Average normalized gain of learning achievement was 0.71 which was in high gain.

INTRODUCTION

Physics is introduced to upper secondary students. However, most students have a negative perspective about Physics. This is because they do not obtain high scores in Physics exams even though they have tried their best. This fact is caused by misconception and lack of understanding about basic Physics concepts Frictional force is one of the topics that students have misconceptions about. Predict-Observe-Explain (POE) is a teaching strategy that probes understanding by requiring students to carry out three tasks. First the students must predict the outcome of some events and must justify their prediction; then they describe what they see things happen; and finally they must reconcile any conflict between prediction and observation. Klopfer and Anderson (1979) were the first to design this strategy as 'demonstrate-observe-explain' to probe the thinking of first year physics students at the University of Pittsburg (Gunstone and White, 1981) reworked the 'DOE' idea which was shifted into 'POE'. Research studies, which used POE with secondary science children to probe children's understanding of science concepts [2]. In this work, we aimed to enhance the students' understanding on the concept of a frictional force by using POE technique.

MATERIALS AND METHOD

The participants in this research were 45 of 10th grade students at Chaiyaphumbhakdeechumphon School, Chaiyaphum province in second semester of 2014 academic year. This study is one group pretest-posttest design. The data were collected by work sheet for 3 lesson plans (two periods of 100 min/plan) based on Predict-Observe-Explain (POE) technique and ten items of frictional force conceptual test. The frictional force conceptual test is two-tier, the first tier is four multiple choice and second tier is open-ended answer for explanation the reason which they had chosen.

Figure 1. POE activit of (a) the first lesson plan (b) the second lesson plan and (c) the third lesson plan

DATA ANALYSIS

T-test was used to compare the difference between average pretest and posttest scores. We selected to calculate the independent samples t-test at .05 significant levels. And Normalized gain was used to obtain the advancement learning achievement students' [3].

Defined as:

$$\langle g \rangle = \frac{\%\langle G \rangle}{\%\langle G_{max} \rangle} = \frac{(\%\langle s_f \rangle - \%\langle s_i \rangle)}{100\% - \%\langle s_i \rangle} \qquad (1)$$

where $\langle g \rangle$ is average normalized gain of a class; $\langle s_f \rangle$ and $\langle s_i \rangle$ are class average score of posttest and pretest.

RESULTS AND DISCUSSION

Part 1: The result of the investigation of the misconception of frictional force

The students' misconception of frictional force was investigated by using the conceptual test. The result showed that the students misunderstood 9 concepts of frictional force.

1. There is no friction when object is at rest.
2. If no force acts upon an object but the object is not moving the magnitude of the friction is zero.
3. If a force acts upon an object but the object is not moving the magnitude of the friction is more than the magnitude of the pulling force
4. There is only one magnitude of static friction but the magnitude of the kinetic friction depends on the magnitude of the pulling force
5. If the magnitude of the pulling force is less than weight of an object, the object will not move
6. The magnitude of the friction on a plan and incline plane is the same
7. If an object moves with a constant velocity, the magnitude of the friction is zero.
8. The direction of friction is always opposite to the direction of the object
9. The magnitude of friction is the same as weight of an object

Part 2: the result of t-test and normalized gain for learning achievement.

Table 1: show average pretest and posttest scores, S.D. and t-test

Test	Score	result		
		$\bar{x}$	S.D.	T-value
Pretest	30	5.91	2.02	55.13*
Posttest	30	23.04	1.38	

The average pretest scores was 5.91, the average posttest scores was 23.04 and t-value was 55.13*. It showed that the average posttest scores was greater than the average pretest scores with statistical significance of .05.

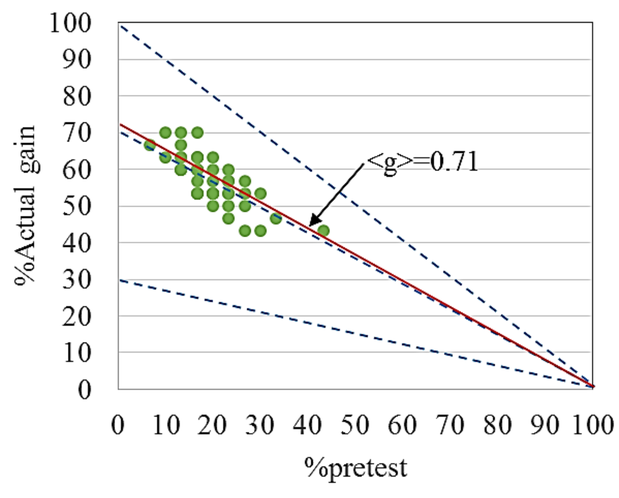

Figure 2. The class average normalized gain

In addition, normalized gain was used for learning achievement of the students. The result was shown in figure 1. The class average normalize gain of learning achievement was 0.71, which was in high gain.

CONCLUSIONS

we have developed and used POE technique to improve the students' understanding on the concept of a frictional force. The result showed that the students misunderstood 9 concepts of frictional force. These misunderstanding of the concepts can be corrected by using POE technique. The average posttest score was higher than that of pretest with statistical significance of .05. The average normalized gain was 0.71, which was in high gain. This study indicates that the POE technique can greatly improves students' understanding of frictional force.

REFERENCE

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