

# The Development of Scientific Concept of “Momentum and Regarding Collision” For Grade 10<sup>th</sup> Students Through Learning Activities Based on The Predict-Observe-Explain (POE) Method.

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## Abstract

The purpose of this research was to develop scientific concepts of momentum and collision for grade 10<sup>th</sup> students through Predict-Observe-Explain (POE) learning activities. There were 34 grade 10<sup>th</sup> students of Roi-Et Wittayalai School, during the second semester of academic year 2014 (November 2014 – March 2015) participated in this study. There were two research tools used in this study. Firstly, the experimental tool is 6 POE lesson plans. Secondly, the data collection tool was a two-tier multiple choice test which was used to investigate the students' understanding of the scientific concept of momentum and collision. The pre-test results showed that most of the students contained partial conceptual understanding while some students represented alternative concepts. In contrast, the post-test showed that the number of students' alternative conceptions was decreased and most of them performed good science conceptual understanding.

**Keywords:** Scientific concepts, Predict-Observe-Explain approach, Momentum and Regarding Collision.

## Introduction

This study focuses on an effectiveness active learning strategy called predict-observe-explain (POE). The POE approach consists of three main steps: 1) predicting the results of a demonstration; 2) observing the demonstration; and 3) explaining and discussing the reasons for the results and comparing them with the initial prediction. It elicits students' existing ideas and also promotes discussion of their ideas. The POE strategy is based on the constructivist learning theory, which proposes that students build their own body of knowledge through their experiences. When students confront a new experience they accommodate it with their existing ideas, perhaps changing what they already know, or perhaps discarding the new information as irrelevant. The constructed knowledge is strongly influenced by the current ideas, and supported by social interactions. In order to walk this line, classroom instructors have to explore what students already know and use this as a primary resource to promote classroom interactions. Additionally, previous researchers have reported positive outcomes for use of POE tasks in several physics topics [4].

Momentum and collision are one of the most difficult topics in physics, and this content is relevant to their daily lives. The students had misconceptions on momentum, most of them contain the concept that not aligned with the scientific concepts [3]. In physics focus on student explain phenomena in nature, if student don't understand and don't liked knowledge between prior knowledge and current knowledge including they can't

apply knowledge, it make student had low achievement and alternative conception.

So, the researcher interested the learning activities based on the predict-observe-explain (POE) method to the development the concept on Momentum and Regarding Collision to make the students had scientific concept in correct and complete.

## Materials and Methods

### Research design

This research forms Pre-Experimental Research (One-Group Pre-test Post-test Design)

### Participants

The participants of this study were 34 grade 10<sup>th</sup> students at Roi-Et Wittayalai School. Roi-Et province, Thailand.

### Instrument

There were two research tools used in this study. Firstly, the experimental tool was 6 POE lesson plans. Secondly, the data collection tool consisted of multiple choice test to investigate the students' understanding of the scientific concept of momentum and collision and it was used to exam pre-test and post-test.

### Data collection

The student exam a pre-test of scientific concepts test on momentum and collisions. The kind of the scientific concept test a two-tier multiple choice which consisted of two parts, the first-tier of each item consists of a content question having four choices; the second part of each item contains reasons for the answer given in the first-tier response. After that, the

researcher provide the learning activities using 6 POE lesson plans. During a lesson plan for collecting data to reflect by teacher who is participant and take collecting data to improve the learning activity in the next time. When using lesson plans completely. The students examine post-test.

### Data analysis

The data analysis is analyze with statistic such ase mean, standard deviation and t-test. The pre-test and post-test results were calculated in percentage and compare of students understanding conceptual into 5 level following Wancharee Mungsing (1993, cited in Waraporn PhuPata 2002) [2] showed in Table 1.

Table 1: The classification of students' answer [2]

Level of understanding	Explanation
Complete Understanding (CU)	The answers and the reason were due to completely understanding of each concept.
Partial Understanding (PU)	The answer and the reason were complete But lack some important elements.
Partial Understanding with Special Alternative Conception (PS)	The answer was correct and the reason some alternative conception.
Alternative Conception (AC)	The answer and reasoning show alternative conception.
No Understanding (NU)	The answer was incorrect or did not respond.

Student's understanding of NU, AC and PS were alternative conceptions while PU and CU were scientific understanding. If misconceptions in pre-test was change to scientific conceptions in post-test. The student's understanding was developed.

## Results and Discussion

### The average of the scientific conceptions on momentum and collisions.

The result of the average of scientific conceptions on momentum and collisions. The pre-test and post-test learning activities base on POE method. Following Table 2.

Table 2: The comparison of the average in the scientific conceptions on momentum and collisions pre-test and post-test

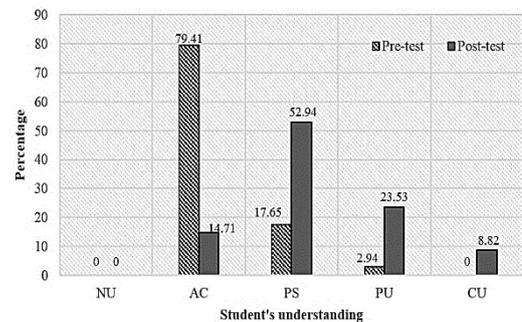
Conceptual test	N	$\bar{X}$	S.D.	t-test	Sig.
Pre-test	34	6.85	2.64	28.87	0.000
Post-test	34	21.15	2.84		

The result in table 2 showed that pre-test was the mean 6.85, the standard deviation of 2.64 and post-test was the mean 21.15, The standard deviation of 2.84. In addition, the results of the paired sample t-test of the data via the momentum and collisions test

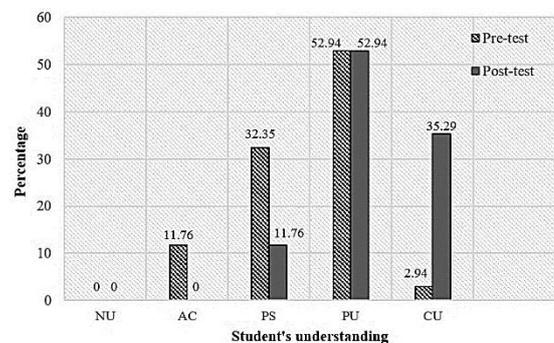
applied to learning POE before and after the study. There are different significant at  $p < 0.05$ .

### Students' understanding about momentum

The scientific conceptions test on momentum had two questions. The results were compared understanding conceptions between pre-test and post-test shown in Figure 1 (a-b).



(a)



(b)

Figure 1. Show the percentage of students' scientific conceptions.

In the question 1 indicated in figure 1 (a). The pre-test, the 97.06 % of students have alternative concepts in the pre-test while 2.94 % of students have understanding concepts. In the post-test, the 67.65 % of students have alternative concepts in the post-test while 32.35 % of students have scientific understanding. It showed that students' understanding was improved 29.41 % in momentum. In response question 2 showed in figure 1(b). In the pre-test, the 44.11 % of students have alternative concepts in the pre-test while 55.88 % of students have scientific concepts. In the post-test, the 11.76 % of students have alternative concepts in the post-test while 88.23 % of students have scientific understanding. It has no NU and AC in post-test and showed that students' understanding was improved 32.35 % in momentum.

The learning using POE on momentum and collisions. The average of the scientific understanding before and after learning higher than before the study. The mean score of understanding conceptions there are difference significantly at  $p < 0.05$ . Before the study using POE students have understanding concepts three level (NU, AC and PS) in pre-test. After learning POE students developed understanding concepts level from

AC though PU and AC. The activities POE allows students to change the completely scientific conceptions. This is consistent with Plerpit Namwad (2011). Found that the learning POE allows students to change the nonscientific understanding to scientific understanding [1].

## Conclusions

The purpose of this research were to develop the scientific concepts on “momentum and regarding collision” for grade 10<sup>th</sup> students through learning activities based on the predict-observe-explain (POE) method. The result showed that quantitative analysis was done in order to find whether there is a significant difference between pre-test and post-test ( $p < 0.05$ ) and the activities POE allows the students to change alternative concepts through complete understanding.

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