How to Use Peer Instruction for Student Teachers: A Case Study of Physics for Teacher I

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Abstract

This study was to study students' physics learning performance on physics for teachers I and to explore what students' opinions were toward physics class after using Peer Instruction (PI) as an undergraduate compulsory course. This case study was classroom research and quasi-experimental research design. The qualitative and quantitative research approach was used to collect the data in the first semester of 2025 at faculty of education, Suan Sunandha Rajabhat University, Bangkok, Thailand. The inferential statistics was used to analyze the quantitative data. Meanwhile, qualitative data were collected by conducting focus group interview and analyzed by using content analysis. The results showed that students' physics learning outcome scores were significant higher after learning through PI class. Their opinions toward PI class were mostly positive while comparing to tradition class.

Keywords: Peer Instruction, Student teacher, Physics for teacher I

1. Introduction

According to Mazur (1997), Peer Instruction or PI is a pedagogical approach in which the instructor stops lecture periodically to pose a question to the students. These questions or Concept Tests are primarily multiple-choice, questions in which the answer options represent common student ideas and main concepts. PI is considered as one of the primarily cooperative and interactive engagement teaching techniques. It was first used at the Harvard University in their large enrolment introductory physics courses teaching by Prof. Eric Mazur Z. Now it has been busing in many universities across the countries (2025).

Mostly common reports on PI researches have focused on measuring the improvement of students learning performance and problem solving skill (2015). In research literature relevant to PI also showed the impacts on three categories: impacts of PI on students' content knowledge, effects of PI on student peer discussion, effects of PI on problem solving skill. In this paper, however, it focused on students' learning performance and their opinions toward peer discussion and PI classroom (2018). The process of using PI in class commonly consists of the following components.

1.1 How to teach using Peer Instruction (PI)

There are mainly three steps to teach by PI as followed by before, during, and after class (2018).

Before class

Students are assigned to complete preparatory work or so called just in time teaching (often textbook reading, but this could include watching online lectures). The goal is to have students learn some of the more basic items, concepts, or definitions before class, so that they do not have to be presented in class, thus creating time for student engagement more. To incentivize students to complete this work, a quiz or other assessment of some sort is given before each lecture.

During class

Students engage with questions designed to help them confront and also explore challenging concepts. Often these questions are posed as multiple-choice and students will gain credit for answering these questions with a clicker. Specifically, the algorithm of a clicker question epics in class should be:

A. Pose a question, students answer individually (generally, results not displayed for class).

B. Small group discussion (2-3 students) where students discuss their thinking and share their analyses with each other.

C. Students all answer a second time, perhaps changing their answer based on group discussion.

D. Class-wide discussion facilitated by the instructor is preferably led by first asking students to share the explanations and discussions they had in their group.

After class

The instructor provides clarification of how the question can be analyzed. The correct answer is clearly indicated. Students in the group should help reflecting their learning results and how to modify.

1.2 Research Objective

In this study, the research objectives were 1**)** to use PI as a teaching technique to teach physics for teacher I course focusing on classical mechanic topics and 2**)** to explore what were their opinion toward PI class comparing to traditional class and how it helps them to learn**.**

2. Methodology

This study was used quasi-experimental research design. The quantitative and qualitative data were collected to fulfill all phenomena in the classrooms. Pre-test and post-test of 30 physics concept questions were given for 68 student teachers who were taking physics for teacher I course in the first semester of 2025 in general science program at faculty of education, Suan Sunandha Rajabhat University, Bangkok, Thailand. The test was checked for the quality of research instrument consisting of reliability, difficulty, and content correction. Student teachers were asked to take the test for one hour before and after the semester. For using PI to teach physics the steps of PI (2008) were as follow:

1. Students were divided into a group of 4-5 depending on where they sat in class.

2. The instructor explained main concept of the topic.

3. The instructor posted the physics question from low to high level of difficulty related to that topic.

4. Students were asked to think individually first and answered by showing the numbers of their fingers according to their best answer.

5. Students discussed and argued within their group on their answer.

6. Students then again answered the last time (they could change their answer if they were convinced by friends).

7. The instructor explained the solution on that problem.

8. If there were many questions on that problem, the instructor would give more problems.

3. Data Analysis

It was one group pre-test and post-test design. The quantitative and qualitative data were collected before and after PI was used teaching this class for two section totally 68 students. The data were analyzed using inferential statistics in this study it was t-test for dependent samples. Descriptive statistics also was used to analyze. Meanwhile to analyze qualitative data, the content analysis was used. The data were coded then grouping them in to category.

4. Results and Discussion

4.1 Comparison of Physics learning outcome

The results are divided into three main parts, first students' physics learning outcome from physics for teacher I class using PI to teach. Their scores from pre-test and post-test were compared and analyzed using t-test. The total score of the test is 30 and took 1 hour to complete.

Table 1*:* The comparison of students' physics learning outcome scores

Test	Mean	SD	P
Pre-test	12.90	0.92	.00*
Post-test	26.64	0.62	

According to table 1, it shows that students' physics learning outcome scores before and after learning through PI have shown significantly different at 0.05 confident level. Therefore, the post-test score of learning outcome is significantly higher compared to pre-test score. That means PI can help improving students' physics learning outcomes.

4.2 Students' opinions toward PI class

Students' opinions toward PI class are shown as below.

Student group 1 *"It is very stress and difficult", "We love physics using PI because it helps us learning together"*

Student group 2 *"Physics is hard, I like the lecture but don't like solving the problems", "We learned more when we did more together in a group"*

Student group 3 *"I can follow and solve the problems but not all", "I like when I have friends discuss with me on solving physics problem and helps setting up hypothesis".*

Student group 4 *"Lecture is fine, but I should prepare well before coming to the class to solve the problems", "We spent less time setting up hypothesis of our experiments when we used PI"*

Student group 5 *"I am lost most of the time", "PI is very useful technique to teach in physics course".*

Student group 6 *"We like when teacher used PI to organize a group task before, during, and after class, it helps explaining more solutions among us"*

According to these opinions it can be indicated that the students think PI class had helped them enjoying and learning more than traditional class that focusing only on lectures.

5. Conclusion and Discussion

This study was to compare students' performance from pre-test and post-test score on physics for teacher I course focusing on classical mechanics using PI technique to teach the class. The result showed that there was a significantly difference between students' physics learning outcomes before and after learning through PI at .05 confident level. Therefore, PI can help improve students' physics learning outcomes. It also focused on what students' opinions toward PI class. The results of this part indicated that their opinions were mostly positive toward PI class. In addition, it helped students to share and learn more from each other.

As shown in the results of Apekshya G. and Chandralekha S. study in 2025 there are some similarity that students' performance were improved after using PI. The result of this study also repeated what Nathaniel Lasry in 2008 had found on the research that PI-taught students demonstrate better conceptual learning and similar problem-solving abilities than traditionally taught students.

One of the main limitations of this study was that it was only a small case study. To make higher impact on larger circumstance it should be repeated in the larger sample size. This was quasi-experimental design because of equality issue so if it can be experimental design that may give more accurate and reliable result. There are many research suggestions on trying PI in different subjects and areas (Trisha, 2015). Therefore, in the future if the researchers want to use PI to improve students' performance, it can be in different circumstances such as in both high school level and in different subjects.

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