A case study of a teaching and learning sequence for Newton's third law of motion designed by a pre-service teacher

T Sujarittham[1,2*] and J Tanamatayarat[2,3]

[1]Department of General Science, Faculty of Education, Bansomdejchaopraya Rajabhat University, Dhonburi, Bangkok 10600, Thailand
[2]Research and Development Institute, Bansomdejchaopraya Rajabhat University, Dhonburi, Bangkok 10600, Thailand
[3]Department of Industrial Physics and Medical Instrumentation, Faculty of Applied Science, King Mongkut's University of Technology North Bangkok, 1518 Pracharat 1 Road, Wongsawang, Bangsue, Bangkok 10800, Thailand

* E-mail address: thanidasu@gmail.com

Abstract. Over several decades, many physics teachers have taken a crucial responsibility for improving conceptual understanding of students. To enhance students' understanding, generally they have adopted an alternative teaching approach to classes. However, such that approach does not always yield positive learning outcomes. Many researchers reported that a teaching and learning sequence was one of the essential factors needed to take into account. In this study, the teaching and learning sequence was proceeded by 5E inquiry-based learning which was grouped as active learning. Therefore, the goal of this study was to analyze the teaching and learning sequence for Newton's third law designed by a pre-service teacher together with the physicists' comments on that sequence. This was viewed as the initial phase of research in finding a suitable framework for future training pre-service teachers about how to design a teaching-learning sequence. The teaching and learning sequence was implemented to the two classes of grade 9 students. From the analysis, we found that the teaching and learning sequence were complicated and some physics situations were not clear. To help support the students' conceptual understanding, all unclear physics situations were refined and corrected in line with physicists' comments to be used in the classes but remained the primary structure of such that designed sequence. The standardized test about force was administered to the students after completing the lesson. The results were found that the designed sequence yielded low learning outcomes even were taught with the interactive engagement. This was the evidence shown that the teaching and learning sequence affected students' leaning and there was a need about seeking a framework to help pre-service teachers in a process of designing a teaching and learning sequence.

1. Introduction

In term of physics education research, many reports have demonstrated that students who can solve physics calculation problems often do not provide the correct physics conception underline such those problems [1-4]. Besides, there has been found that students who have high achievement scores in physics, it does not imply that they have solidify physics concepts [5-6]. In particular, the concept of force and motions were commonly explained from students' common-sense beliefs or intuitions [1]. This difficulty provoked many physics researchers to invent standardized tests [2, 7-9] in order to