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How to develop modelling competence for Vietnamese students

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How to develop modelling competence for Vietnamese students
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Abstract.
Developing modeling competence is an educational objective in many countries such as “SEP 2: Developing and Using Models” in Next Generation Science Standards (NGSS). In Vietnam, the new physics-education curriculum has clearly defined the key learning outcomes, including modeling-competence elements as well. Experiencing modelling cycle is an effective way to develop modelling competence for students. Our recent work studies which tool is suitable for students and how to integrate this tool in modelling activities. This paper presents the use of Coach 7 modelling software to investigate common physics phenomenon of oscillations, shows feasibility and effectiveness of these activities via tryout.
1. Introduction
Development of modeling competence is an educational goal in many countries, for example “SEP 2: Developing and Using Models” in Next Generation Science Standards (NGSS). In Vietnam, the new physics-education curriculum has clearly defined the key learning outcomes which include modeling-competence elements such as understanding model/modelling, developing model, and using model in reasoning and predicting real-life phenomenon (Table 1).
Table 1. Framework of modeling competence, adapter from Papaevripidou, Nicolaou Constantinou (2014) and Mei-Hung Chiu, Jing-Wen Lin (2019)

Modeling cycle is a cognitive method used by scientists in many fields to describe, explain, and predict about systems, phenomena, complex process. Experiencing modelling cycle is an effective way to develop modelling competence in students.
2. Integration of Coach in modelling activities in schools
Authentic inquiry of physics phenomena must consider friction, energy loss, and change of influential factors. For example, the oscillation of spring pendulum can be damped by fluid resistance. Regarding theoretical deduction, this consideration often yields to differential equations which school students cannot solve with their current mathematics knowledge. Modeling by Coach 7 (Ellermeijer, Tran, 2019) helps to investigate both mechanical and electrical oscillations (Figure 1, Figure 2).
Based on the modelling cycle (Figure 3), the modelling method for teaching real-life phenomena with modelling tool like Coach is developed. This method is elaborated into modelling activities to investigate electrical oscillation in LC circuit and then tried out with 30 students in a gifted high school in Vietnam to evaluate if it can help to develop student’s modeling competence.
Fig.3 Phases of modelling method for teaching real-life phenomena and opportunities to develop the corresponding elements of modeling competence

1. Tryouts and discussions The school tryout showed that students can fulfil phases of modelling method. Modelling performance indicators: “identify the nature of the phenomenon, the real life process”, “evaluating and revising models” were observed in most students, while other indicators were not yet. There need more modelling activities with Coach to develop in students modelling competence to larger extent.

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