Analysis of Atomic Models in High School Physics Textbooks

Authors : Meng-Fei Cheng, Wei Fneg

Abstract : New Taiwan high school standards emphasize employing scientific models and modeling practices in physics learning. However, to our knowledge. Few studies address how scientific models and modeling are approached in current science teaching, and they do not examine the views of scientific models portrayed in the textbooks. To explore the views of scientific models and modeling in textbooks, this study investigated the atomic unit in different textbook versions as an example and provided suggestions for modeling curriculum. This study adopted a quantitative analysis of qualitative data in the atomic units of four mainstream version of Taiwan high school physics textbooks. The models were further analyzed using five dimensions of the views of scientific models (nature of models, multiple models, purpose of the models, testing models, and changing models); each dimension had three levels (low, medium, high). Descriptive statistics were employed to compare the frequency of describing the five dimensions of the views of scientific models in the atomic unit to understand the emphasis of the views and to compare the frequency of the eight scientific models' use to investigate the atomic model that was used most often in the textbooks. Descriptive statistics were further utilized to investigate the average levels of the five dimensions of the views of scientific models to examine whether the textbooks views were close to the scientific view. The average level of the five dimensions of the eight atomic models were also compared to examine whether the views of the eight atomic models were close to the scientific views. The results revealed the following three major findings from the atomic unit. (1) Among the five dimensions of the views of scientific models, the most portrayed dimension was the 'purpose of models,' and the least portrayed dimension was 'multiple models.' The most diverse view was the 'purpose of models,' and the most sophisticated scientific view was the 'nature of models.' The least sophisticated scientific view was 'multiple models.' (2) Among the eight atomic models, the most mentioned model was the atomic nucleus model, and the least mentioned model was the three states of matter. (3) Among the correlations between the five dimensions, the dimension of 'testing models' was highly related to the dimension of 'changing models.' In short, this study examined the views of scientific models based on the atomic units of physics textbooks to identify the emphasized and disregarded views in the textbooks. The findings suggest how future textbooks and curriculum can provide a thorough view of scientific models to enhance students' model-based learning.

Keywords : atomic models, textbooks, science education, scientific model
Conference Title : ICPSELS 2018 : International Conference on Pedagogical Sciences and Effective Learning Strategies
Conference Location : Singapore, Singapore
Conference Dates : May 03-04, 2018